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The Most Proficient Years at Sports and Games

By Harvey C. Lehman
Ohio University

WHAT are the chronological ages at which men exhibit their greatest physical skill? What are the ages at which individuals are most likely to win (or retain) various kinds of championships? Study of the chronological ages at which men have achieved their most outstanding performance is, of necessity, limited to behaviors which can be evaluated or appraised, and which can therefore be dated with a reasonable degree of precision. In previous articles the present writer and his associates have presented factual data regarding the most creative years in the fields of science, invention, literature, and music.[1]* The present paper sets forth the chronological ages at which extraordinary proficiency has been exhibited most frequently by the following kinds of performers:

1. Professional baseball players
2. Professional pugilists
3. Amateur tennis players
4. Professional ice hockey players
5. Professional football players
6. Automobile racers
7. Corn huskers
8. Bowlers
9. Rifle and pistol shooters
10. Duck pin bowlers
11. Professional billiardists
12. Professional and amateur golfers.

METHOD

In the most recent edition of his *All Sports Record Book*, F. G. Menke lists for numerous sports and games the following information:[2] (1) The names of the annual champions, (2) the national and the world record-holders, and (3) the years during which both the annual champions and the record-holders won or retained their honors. In order to determine the chronological ages of the performers at the time they exhibited their superior abilities it was necessary to obtain their birth dates. The latter information was obtained by writing to the secretaries, or other executives, of organizations which control or which sponsor the various sports. The procedure that was employed for the study of professional baseball players will first be described.

PROFESSIONAL BASEBALL

Study of age differences in baseball proficiency would be a relatively simple task if all the major league players started to play in the major leagues at very youthful ages and if all continued to play in the major

*Indices refer to Bibliography at end of article.

leagues until they were quite old. In the latter case it would be possible to make a simple, direct comparison of the average performance of each successive age group. But, because selective factors operate so constantly and so relentlessly, it is not possible to employ the foregoing procedure. For this same reason the correlation technique is likewise quite useless for the study of age differences. Indeed, careful analysis of the available data reveals that the average proficiency of the several age groups that participate in major league baseball does not differ appreciably. This is due to the fact that the professional ball player is not employed by the league management until he has exhibited a high level of proficiency. And, as soon as a particular player falls below a very high standard of excellence, he is released by the management and no longer permitted to exhibit his lesser skill in the same class of baseball competition.

Since players are not permitted to remain in the major leagues when they fail to display very great skill, the writer has studied age differences in baseball proficiency by simply tabulating the ages of individuals whose names appeared in the successive annual editions of *Who's Who in Baseball*[3] from 1916 to 1938 inclusive.*

In the foreword of *Who's Who in Baseball,* the publishers make the following explanatory statement:

> This book, as its name implies, is devoted to the better known or more talented players of the two major leagues. *Who's Who* does not claim to present the records of all the major league players nor even of all the regulars. Such an attempt would be impossible, if for no other reason, because of the continually changing personnel of the big clubs.

If the editors of *Who's Who in Baseball* have succeeded in listing the more talented players of the two major leagues, tabulation of the ages of the players whose names are included each year should reveal the chronological ages at which baseball players are maximally proficient.† What are the chronological ages at which players most frequently exhibit such a high degree of baseball skill as to warrant inclusion of their names in *Who's Who in Baseball?*

Figure 1 presents a composite picture of the ages of the most talented major league players (other than pitchers‡) for a period of 22 years. This figure sets forth data for 3,126 player-years. As here used the term "player-year" posits merely one full year's performance in a major league club, plus inclusion of the player's name in *Who's Who in Baseball* for the succeeding year.§ Since the names of some

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*The issue of *Who's Who in Baseball* for the year 1922 (if there was one) was not available to the writer.

† It seems safe to assume that, in making their annual selections, the publishers of *Who's Who in Baseball* did not exhibit prejudice for or against any particular age groups.

‡ Data are presented separately for baseball pitchers.

§ Each edition of *Who's Who in Baseball* contains data for the previous year. It was therefore necessary to make allowance for the fact that the individual's playing

of the major league players are included more than once in *Who's Who in Baseball,* it should be clearly understood that Figure 1 does not present data for 3,126 different individuals. The 3,126 player-years were contributed by perhaps 500 to 600 different individual players. The following computation will enable the reader better to understand the cross-sectional data that are revealed in Figure 1:

22 = Number of editions of *Who's Who* that were canvassed.
3,126 = Total number of player-years during the 22-year period.
22) 3,126
142.09 = Number of player-years for each of the 22 seasons.
16 = Number of clubs in the two major leagues.
16) 142.09
8.88 = Average number of players (excluding pitchers) included in *Who's Who* each year from each of the 16 major league clubs.

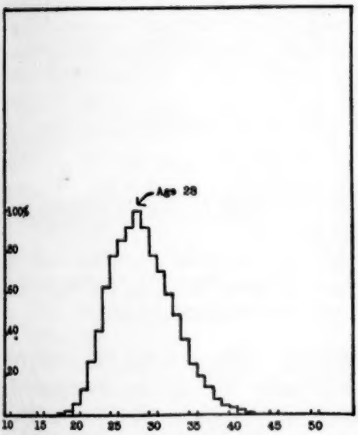

FIGURE 1. Chronological ages of major league baseball players (other than pitchers). A 22-year cross-sectional study involving 3,126 player-years.

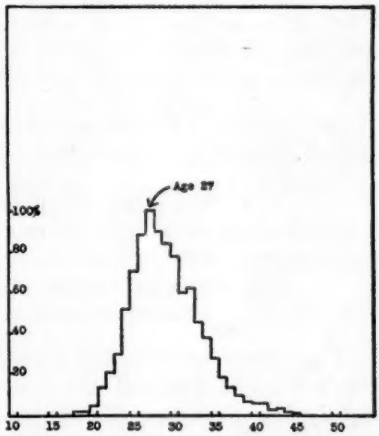

FIGURE 2. Chronological ages of major league baseball pitchers. A 22-year cross-sectional study involving 1,666 pitcher-years.

The foregoing computation reveals that, in compiling the annual editions of *Who's Who in Baseball,* the editors usually select an average of slightly less than nine men (excluding pitchers) from each of the sixteen major league baseball clubs. It seems obvious that, as a group, the individuals whose names are included during a given year in *Who's Who in Baseball* are the most talented baseball players of the United States (and of the world).

skill was exhibited one year prior to the publication of a given edition of *Who's Who.* It was likewise necessary to allow for the fact that the baseball playing season does not coincide with the calendar year. Since *Who's Who* publishes the day and the month, as well as the year, of birth, the latter computation afforded no insuperable difficulty.

Figure 1 reveals that players' names are sometimes included in *Who's Who in Baseball* when the players are less than 20 years of age. And a few individuals are included in this very select compilation when they are past 40 years of age. However, the 28-year-olds (this means players between their 28th and their 29th birthdays) comprise the largest single age group. And the three age groups, 27, 28, and 29 inclusive, stand distinctly above the others in the extent to which they participate in major league baseball.* It should be realized, of course, that the foregoing statement implies that *general* baseball proficiency is probably greatest within the three above-mentioned age groups. With the available data, it would easily be possible to determine whether there exist statistically significant age differences with respect to such separate performances as batting, fielding, base-stealing, and so forth. The fact that such age differences may exist will be more fully realized when the reader examines Figure 2 which sets forth data for 1,666 baseball pitcher-years. The data for Figure 2 were obtained from *Who's Who in Baseball* in a manner analogous to that employed for obtaining the data for Figure 1. The following computations reveal the very select nature of the pitcher group:

22 = Number of editions of *Who's Who* that were canvassed.
1,666 = Total number of pitcher-years.
22) 1,666
75.727 = Number of pitcher-years for each of the 22 seasons.
16 = Number of clubs in the two major leagues.
16) 75.727
4.733 = Average number of pitchers included in *Who's Who* each season from each of the 16 major league clubs.

The above computation reveals that, in their annual editions of *Who's Who in Baseball,* the editors ordinarily include an average of slightly less than five pitchers from each of the sixteen major league clubs. Figure 2 reveals that, of the pitchers whose names were listed in *Who's Who in Baseball* for a period of 22 years, the 27-year-olds comprise the largest single age group. The modal age for the pitchers is thus one year younger than the modal age for players other than pitchers.

Figures 1 and 2 make no allowance for the fact that there is always a larger number of young than of older men in the population at large.†

*In constructing the graphs that accompany this article, the data for each of them were first reduced to a comparable basis by the following procedure: The peak of each statistical distribution was arbitrarily assigned a value of 100 per cent and the other numerals within the same statistical distribution were assigned proportionate percentage values. For example, in Figure 1, the peak of the distribution occurred at age 28. At this latter age the number of baseball player-years was 322. In Figure 1 at age 28 the figure 322 is plotted therefore as 100 per cent. At age 30 the number of player-years was 252. This figure is equivalent to 78 per cent of the maximum (78 per cent of 322) and in Figure 1 the numeral 252 is plotted therefore as 78 per cent. The foregoing method of plotting should be borne in mind when studying the graphs.

† This might not be true for a country which has had a declining birth rate for many years.

In order to avoid unfairness to the older age groups, one probably should compare the number of baseball players within a given age group with the total white male population of corresponding chronological age. The latter procedure enables one to answer the following question:—In proportion to the total number of living, eligible males, to what extent does each age group participate in major league baseball?

Since data for the years 1916 to 1938 inclusive* were utilized for constructing Figures 1 and 2, census data for 1920 and 1930 were combined in making allowance for the population differences at the several age levels. When the data were grouped by five-year intervals, and the correction for population differences was made, this correction changed the shape of the age curves only slightly, and the resultant age curves, for pitchers and for non-pitchers, were almost identical. Indeed, these curves yielded no hint that the modal ages of pitchers and of non-pitchers differ by a full year.

LEAGUE CHAMPIONS

League champions at batting, pitching, base-stealing, and the like are identified each year. The competition to win these league championships is exceedingly keen since the winners can usually command large salary increases when they are offered contracts for the succeeding year. Which of the age groups most frequently win these championship honors? In the *All Sports Record Book*[2] for 1936 Menke presents the following information: †

1. The batting champions of the National League from 1876 to 1936 inclusive.
2. The batting champions of the American League from 1900 to 1936 inclusive.
3. The pitching champions of the National League from 1876 to 1936 inclusive.
4. The pitching champions of the American League from 1900 to 1936 inclusive.
5. The stolen-base champions of both major leagues from 1907 to 1936 inclusive.

The birth dates of some of the above-mentioned champions were available in *Who's Who in Baseball.* But, since the first edition of *Who's Who in Baseball* did not appear until 1916, it was necessary to obtain the birth dates of the earliest champions from other sources as follows: (1) The Service Bureaus of the two major baseball leagues,‡ (2) biographies of baseball players, and (3) personal correspondence with a number of the early champions who are still living.

* Excepting only for the year 1922.

† Except when otherwise stated, the data regarding championship performance were procured from Menke's books.

‡ The writer is indebted to Mr. Henry P. Edwards, Manager of the Service Bureau of the American League of Professional Baseball Clubs, and also to Mr. Wm. E. Brandt, Manager of the Service Bureau of the National League of Professional Baseball Clubs. Thanks are due also to individual players who provided the writer with their birth dates.

Tables I and II (rows 3, 4, and 5) reveal the chronological ages at which: (1) 96 major league baseball players were the batting champions (best-hitters) of their respective leagues, (2) 88 pitchers led their respective leagues at pitching, and (3) 63 players were league champions at base-stealing. Since there are more major league players at ages 25 to 29 inclusive than of any other five-year interval, one would naturally expect that this age group would contribute the most league champions. Table II reveals that this expectation is fulfilled. It will be noted from Table II that the age differences for the three kinds of championship performance are relatively slight and perhaps not statistically significant. With more data available future investigators will be able to determine for these separate performances whether or not significant age differences exist.

PROFESSIONAL PUGILISTS

The names of the champion boxers of the world and the years during which they won or retained their titles were procured from Menke. The birth dates of the pugilists were found in Romano's *Post Boxing Record*.[4] Figure 3 presents data for 133 world champions (of all weight classifications) who held their various boxing championships for a total of 448 years or fractions of years. Although in Figure 3 the peak of the age curve occurs at age 26, study of the data reveals that the age of maximum success varies somewhat for the different weight classifications.

Except when they are competing for the heavyweight championship, boxing contestants must meet certain specified weight requirements.

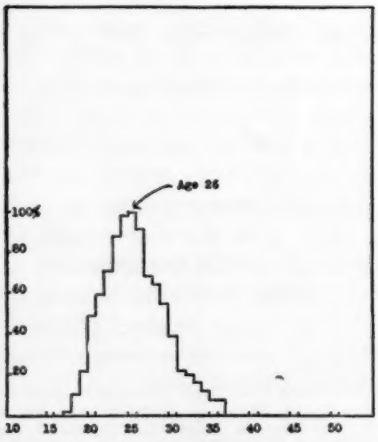

FIGURE 3. Chronological ages at which 133 boxers won or retained 448 world championship titles—all weight classifications.

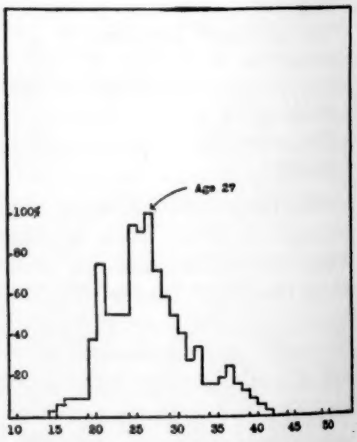

FIGURE 4. Chronological ages at which 317 national tennis championships (English, American, and French) were either first won or retained.

Therefore, in some instances, younger boxers are able to supplant their older rivals, not because of superior boxing ability, but because the titleholder is no longer able to meet the weight requirement. This situation may account in part for the fact that the pugilists in the heavier weight classifications are found to be slightly older than are the boxers in the lighter weight classifications. For the heavyweight championships, the mean chronological age was 29.79; for the bantamweight championship, the mean was 24.83 years.

AMATEUR TENNIS PLAYERS

Figure 4 presents the chronological ages at which 317 national amateur tennis championships were either won or retained in France, England, and the United States.* The 317 tennis championships include outdoor and indoor, singles and doubles. The year of maximum success at tennis was age 27. The irregularity in the appearance of the age curve at ages 21 to 24 is probably due to chance factors. The writer can think of no logical reason why a spurt should occur at age 21 with a decline of ability from ages 22 to 24 inclusive.

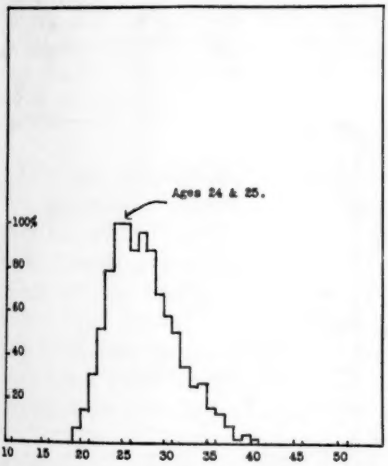

FIGURE 5. Chronological ages of professional ice hockey players. A 5-year cross-sectional study involving 823 player-years.

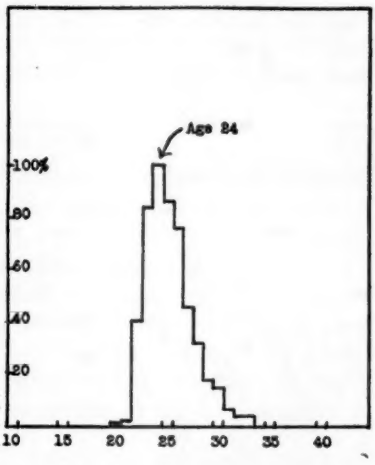

FIGURE 6. Chronological ages of professional football players. A 2-year cross-sectional study involving 485 player-years.

PROFESSIONAL ICE HOCKEY PLAYERS

For studying the ages of professional ice hockey players, the writer tabulated the ages of the players whose names appeared in five annual

*The birth dates of the United States tennis players were supplied by Mr. Edward B. Moss, Executive Secretary of the United States Tennis Association. Birth dates of the French champions were obtained from Mr. P. Gillou, Federation Francaise de Lawn Tennis. The birth dates of the English champions were supplied by Mr. H. A. Sabelli, The Lawn Tennis Association, London, England.

editions of the *National Hockey Guide.*[5] The players whose names are listed during a given year in the "Who's Who" roster of the *National Hockey Guide* are probably the most skillful hockey players on the North American continent.

Figure 5 sets forth cross-sectional data for a five-year period, the total number of player-years being 823. Ice hockey players are most frequently at their best from ages 24 to 25, and the most successful five-year interval is that from ages 24 to 28 inclusive. It should be understood of course that this statement applies to the hockey players as a group. It does not apply to every individual player.

PROFESSIONAL FOOTBALL

Figure 6 presents the ages of professional football players. The names of the players and their chronological ages were obtained from *Who's Who in Major League Football.*[6] Figure 6 reveals that professional football players are rarely less than 22 years of age, a finding which is explained by the following quotation:

"The National League made peace with the college critics when it decreed that no university player can be signed until his class has been graduated. . . Professional football is reserved for those who have completed their college courses." [6a]

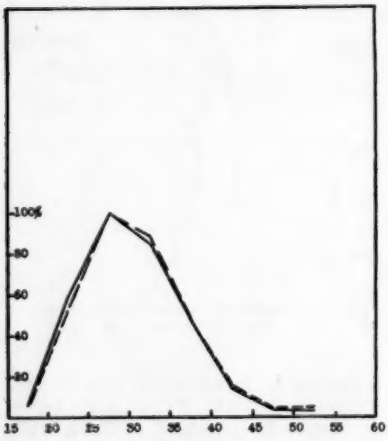

FIGURE 7. Chronological ages at which 87 state corn-husking championships were won or retained. The broken line makes allowances for the population differences at the various age levels.

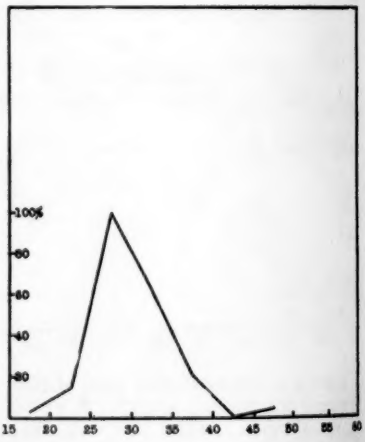

FIGURE 8. Chronological ages at which drivers won either first, second, or third place in the Indianapolis Speedway Races.

Because of the selective factor that is mentioned in the above quotation, we can say only that the modal age for football proficiency probably occurs *not later* than that which is set forth in Figure 6,

namely, age 24. It is of course possible that, if the professional football managers recruited players indiscriminately from all age groups, the modal year might fall at a younger age level.

CORN HUSKERS

In Figure 7 the solid line presents the chronological ages at which 87 state corn-husking championships were won. This solid line makes no allowance for population differences at the various age levels. In this figure the broken line makes allowance for the population differences at the various age levels. Figure 7 reveals that, when allowance is made for the differences in total male population at the various age levels, the shape of the age curve is changed only very slightly. This latter statement is applicable also to most of the other age curves that are presented herein.

It should perhaps be explained that all of the data regarding the corn-husking championships were supplied by the editors of the farm papers which sponsor the state husking contests.* At the present time (1938) these state contests are being held in no less than nine different states. Although the peak of the age curve in Figure 7 occurs at ages 25 to 29 inclusive, the one year of most frequent success at husking is age 30, and the five-year interval of greatest success is that from ages 26 to 30 inclusive.†

AUTOMOBILE RACERS

On each Memorial Day the Indianapolis Motor Speedway Corporation sponsors a 500-mile auto race. The contestants are drawn from over the entire United States and even from Europe. The size of the cash awards guarantees that the participants are highly motivated.‡ What are the chronological ages at which men are most likely to win either first, second, or third place in this classic auto race? Figure 8 sets forth data for 54 winners§ of the Indianapolis auto race, due allowance being made for the population differences at the various age levels. Figure 8 reveals that, although the ages of the 54 winners range from

*The following editors supplied the birth dates of the corn-husking champions: (1) Indiana and Illinois, Mr. M. C. Gregory, Ass't. Editor of the *Prairie Farmer;* (2) Kansas, Mr. Tudor Charles, Asso. Editor of the *Kansas Farmer;* (3) Nebraska, Mr. Henry W. Biedermann, Asso. Editor of *The Nebraska Farmer;* (4) Ohio and Iowa, Mr. E. W. McMunn, Ass't. Editor of *The Ohio Farmer.* (5) The names and addresses of the Minnesota and the South Dakota champions were supplied by Mr. Berry Akers, Editor of *The Farmer* (St. Paul). The birth dates of these latter husking champions were obtained by personal correspondence.

† To date 13 national championships have been won—not enough for the construction of an age curve. However, it is of interest that 10 of the 13 national husking championships were won at ages 26 to 32 inclusive.

‡ According to daily press reports, first place in the Indianapolis race was worth approximately $35,000.00 to the winner of the 1937 contest. The second prize amounted to $10,000.00; third prize was $5,000.00; fourth prize was $3,500.00; and fifth prize was $3,000.00.

§ For the birth dates of the automobile racers the writer is indebted to:—(1) Mr. T. E. Allen, Sec. of the Contest Board of the American Automobile Association, (2) Mr. T. E. Myers, of the Indianapolis Motor Speedway Corporation, and (3) Mr. S. C. H. Davis, Sports Editor of *The Autocar.*

19 to 45, the winners of the 500-mile race are most frequently from ages 25 to 29 inclusive.

Since the year 1911 the American Automobile Association, governing body of all sanctioned races in the United States, has used a point system for ascertaining the national driving champion for each season.[2] Points are awarded for the position in which each man places in the different speedway races of the year, and the national champion is thus determined. Analysis of the data reveals that, of the 23 National Auto Champions that have been selected to date, fifteen (65 per cent) were from ages 27 to 30 inclusive at the time they won national honors.

BOWLERS

In Figure 9 the solid line sets forth data for 238 bowling championships, including individual events, two-man events, five-man events, and all-events.* Since some of the bowlers won more than one kind of bowling honor, the number 238 should not be taken to imply that data are presented in Figure 9 for 238 different individuals. The dash line in Figure 9 reveals the chronological ages at which 58 individual events, and all-events were won.†

It will be noted in Figure 9 that the solid line is relatively flat at the top, whereas the dash line is much narrower. This difference in the shapes of these two curves illustrates a significant fact, namely, that the shape of a performance age curve is a function not only of type of behavior; it varies also with the excellence of the performance. For example, in Figure 9, the dash line presents data for the best individual performance. The solid line, on the other hand, presents data for both individual performance and team performance. In assembling a bowling team, it is usually necessary to include as team members individuals who are not equal in skill to the best performer on the team. It seems obvious that the best individual performers are likely to demonstrate their full merit only when they perform singly. If the foregoing hypothesis be valid, the dash line in Figure 9 reveals that the most skillful individual performance in bowling is likely to occur at ages 30 to 34 inclusive. For team performance, that does not usually reach such a high standard of excellence as does the most outstanding individual performance, the peak of the age curve is less clear-cut. In other words, team success at bowling seems to be attained over a wider age range than does individual success.

RIFLE AND PISTOL SHOOTERS

The Executive Vice-President of the National Rifle and Pistol Association assembled and forwarded complete information, including the birth dates, of 307 marksmen who, collectively, had won 630 local,

* For data regarding the bowlers, the writer is indebted to Mr. E. H. Baumgarten, Secretary of the American Bowling Congress.

† In Figure 9 both age curves make allowance for population differences at the various age levels.

state, regional, national, and world championships.* With the foregoing data numerous age curves were constructed but in this brief article it will be possible to present only a summary of the findings. In Figure 10 the solid line presents the combined data for the 630 rifle and pistol championships. When the data for the rifle and for the pistol shooters were plotted separately, the peaks of both of the age curves were found to occur at ages 25 to 29 inclusive.

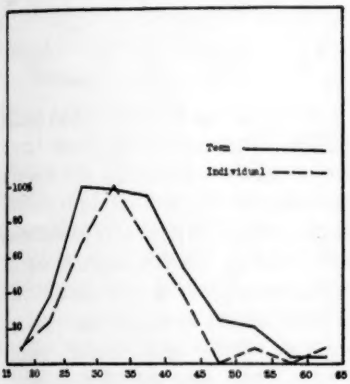

FIGURE 9. Chronological ages at which American Bowling Congress Championships were won or retained. A, team performance; B, individual performance.

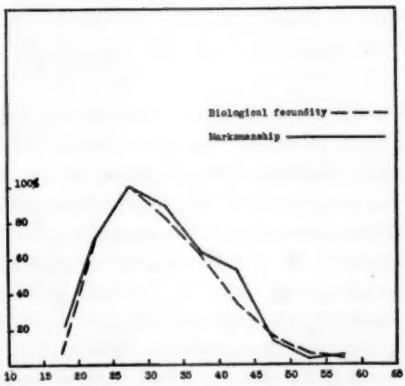

FIGURE 10. A, chronological ages at which 630 rifle and pistol championships were won; B, ages of fathers of children born in the United States in the year 1931.

The dash line in Figure 10 presents information regarding biological fecundity. This dash line, which reveals the number of men who become fathers at successive age levels, is based upon more than 2,000,000 births which occurred during the year 1931.[7] Since similar age curves were found when data for fecundity were plotted separately for several different years, it seems safe to assume that the dash line in Figure 10 is a trustworthy portrayal of the facts regarding man's biological fecundity at various age levels. It will be noted that there is much similarity between the two curves of Figure 10.† It is because of this marked similarity that these two age curves are superimposed in Figure 10.

DUCK PIN BOWLERS

Figure 11 presents data for Duck Pin Bowlers.‡ In this figure the solid line presents data for men only, e.g., for 91 National Duck Pin

* Data regarding the rifle and pistol shooters were supplied by Col. M. A. Reckord. Thanks are expressed herewith for this wholehearted cooperation.

† In Figure 10 neither of the age curves makes any allowance for the fact that there are more young men than older men. When such allowance is made, however, the two age curves exhibit about the same degree of similarity.

‡ For the data regarding the Duck Pin Bowling champions, the writer is indebted to Mr. G. L. Isemann, Secretary of the National Duck Pin Bowling Congress.

Bowling Congress champions. The dash line in Figure 11 sets forth analogous data for 90 women champions. The women's age curve rises and descends five years earlier than does the curve for the men. The peak for the men's curve occurs at ages 30 to 34 inclusive, the apogee for the women's curve occurs at ages 25 to 29 inclusive. Of interest in this connection is the fact that, when a fecundity age curve was plotted for women, its highest point occurred five years earlier than did the highest point of the age curve for male fecundity (see Figure 10).

PROFESSIONAL BILLIARDISTS

In the July, 1934, issue of the *Billiards Magazine* is a list of the birth dates of more than 100 noted billiardists.[8] Supplementary lists have been published subsequently in the same magazine. Menke's *All Sports Record Book* for 1935 gives the years during which various billiardists were champions and also the years during which various professional world billiard records were broken.[2] In studying the billiardists, as in studying the other performers that are mentioned herein, one credit was assigned to a given age group if a billiardist of that particular age group broke a world record. If the same individual broke world records at several different age levels, one credit was allotted to each appropriate group. If a given player broke three world records during a single year, three credits were allotted to his age group.

In Figure 12 the dash line reveals the chronological ages at which

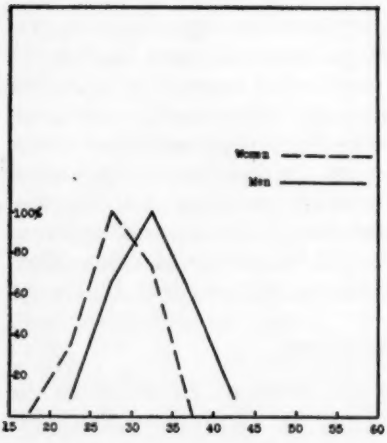

FIGURE 11. Ages at which National Duck Pin Bowling Championships were won or retained. A, women bowlers; B, men bowlers.

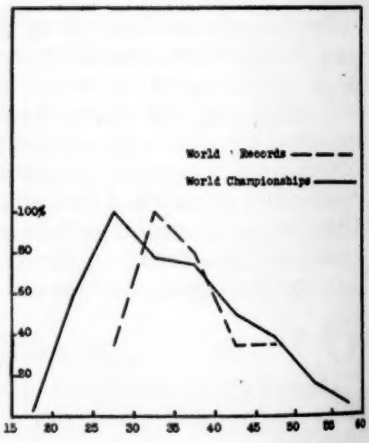

FIGURE 12. A, chronological ages at which 136 professional world championships at billiards were won or retained; B, ages at which 42 world records were established.

42 professional world billiard records were broken. The solid line of Figure 12 reveals the ages at which 136 professional world championships were either won or retained.* Figure 12 suggests that professional world billiard championships are most likely to be won or retained by players of ages 25 to 29 inclusive, and that world records at billiards are most likely to be broken by players when they are from ages 30 to 34 inclusive. Figure 12 suggests once again that the very best performance is likely to be attained during a somewhat narrower age range than is performance of lesser merit. Thus, the age range for world championship performance is from 19 to 55, but the age range for the breaking of world records is from 26 to 49.

GOLFERS

Figure 13 presents the ages at which 48 American and British golfers held the Professional Golf Championships of their respective countries.† In Figure 13 the apogee of the age curve occurs very definitely at ages 30 to 34 inclusive, and the findings are quite similar when separate age curves are constructed for the two national groups.

When data were assembled separately for 88 American and British Open Golf Championships, it was found that 24 of them had been won at ages 25 to 29, and that 23 of them had been won at ages 30 to 34. Thus, 47 of the Open Golf Championships of England and of America (53 per cent) were won during the ten-year interval 25 to 34 inclusive. Since the difference between the 25 to 29 and the 30 to 34 age groups amounts to only one championship out of 88, it will perhaps be best to postpone decision regarding the five-year interval of greatest success at winning Open Golf Championships. However, detailed analysis of the data for amateur golfers reveals that the national amateur golf championships (both the British and the American) have been won most often by individuals who were from ages 25 to 29 inclusive.

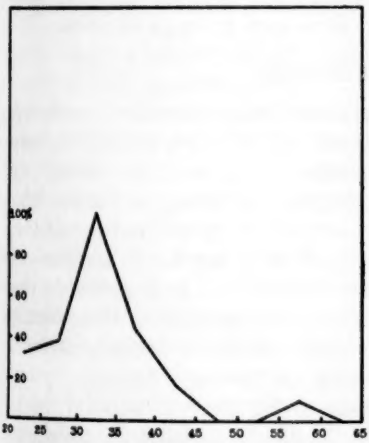

FIGURE 13. Chronological ages at which 48 American and Britishers became professional golf champions of their respective countries.

Some readers may wonder why

*In Figure 12, and in Figure 13, no correction was made for population differences at successive age levels because census data for the various countries of the world were not easily available to the writer.

† Data regarding the birth dates of the golfers were supplied by Mr. R. W. Treacy, former Secretary of the Professional Golfers' Association of America, and by Mr. R. C. T. Roe, Secretary of the Professional Golfers' Association [of England]. Supplementary information was obtained also from the *Tournament and Player Record Book* for 1935. Chicago: Published by the Professional Golfers' Association of America.

the writer has not combined the data for amateur, for open, and for professional golf champions. There is a valid reason for not doing this. In the first place, the National Amateur Championship is probably the easiest to win. The basis for this assertion is the well known fact that when the National Open Golf tournaments are held, only a very few amateurs are to be found among the leading contestants. This seems to afford sufficient reason for treating the amateur championships separately. Secondly, correspondence with an eminent golfer elicited the following statement regarding the Open and the Professional Championships:

> It is generally conceded that the annual championship of the P.G.A. is the hardest to win. This is because the winner must maintain a top form for six days. Thirty-six holes a day for six days is more of a physical grind than three days at 18–18–36, as is the case in the Open. From the psychological standpoint the Open undoubtedly is harder on the nerves for the reason that there is more of a publicity build-up, the pace is always fast, and every player knows that one or two missed shots may end in disaster—more so than in the match play P.G.A. even.

Whether or not the foregoing analysis is wholly valid, since the Open and the Professional tournaments are not the same kind of contest, no mistake will be made if the data for them are treated separately. Such separate treatment reveals clearly that the ten-year interval of greatest golf proficiency is that from ages 25 to 34 inclusive.

FURTHER REMARKS

Most of the athletes for whom data have been assembled herein are, or were, professionals. Since professional athletics are profitable financially to successful participants, it seems likely that the various age groups continue to participate in professional athletics as long as they are able to profit thereby. And they are able to profit so long as they retain unusual skill. Amateur athletics, on the other hand, are likely to be an expensive luxury to the ordinary individual. It is probable that many individuals forsake amateur endeavor not because of their waning proficiency but because they find amateur athletics very costly in terms of time, energy, and money. Certainly, the average American youth cannot afford to devote a major share of his time to activity which yields no financial return. Therefore, it should perhaps be concluded

* This hypothesis may explain in part why the amateur golf champions are younger than the professional golf champions. The present writer has found also that amateur boxers and amateur baseball players (Olympic entrants) are younger than are professionals who participate in the same types of activities. The foregoing hypothesis also provides an explanation for the curious shape of Figure 4 which sets forth data for amateur tennis championships. Professional tennis is of such recent origin that data for the construction of an age curve are not yet available. Nevertheless, it seems safe to predict that, when sufficient data can be assembled to permit the construction of a curve showing the ages at which a large number of professional tennis championships have been won, the latter curve will exhibit a gradual annual rise and an equally gradual decline. It is probable that the age curve for professional tennis championships will bear a closer resemblance to Figure 1 (see page 5) than to Figure 4 (see page 8).

TABLE I

SUMMARY OF FINDINGS WITH REFERENCE TO PROFICIENCY AT SPORTS AND GAMES

Types of Activity	No. of Cases	Mean Age	Standard Deviation	Yrs. of Maximum Proficiency
Professional baseball (not inc. pitching)	3,126	29.07	4.04	28
Professional baseball (pitching)	1,666	29.50	4.39	27
Major league batting championships..	96	29.16	3.46	26–29
Major league pitching championships..	88	28.18	3.72	26–31
Major league stolen-base championships	63	27.96	3.46	25–29
Professional boxers	448	26.98	3.98	25–26
Tennis champions (French, English and American)	317	27.63	5.25	25–27
Professional ice hockey players	823	27.56	4.00	24–25
Professional football players	485	25.72	2.33	24
Corn-husking champions	87	30.39	6.20	26–30
Automobile racers	54	28.81	4.50	27–30
Bowling champions (individual performance)	58	32.78	7.56	30–34
Bowling champions (team performance)	238	33.38	7.83	27–37
Rifle and pistol shooters	630	32.05	8.13	27
Duck pin bowlers (men)	91	32.19	4.36	30–34
Duck pin bowlers (women)	90	28.13	3.47	25–29
Billiards (world record breakers)	42	35.67	5.83	30–34
Billiards (world championship winners)	136	34.35	8.75	25–29
Golf (professional championships—English and American)	48	32.33	6.49	30–34
Golf (open championships—English and American)	88	31.01	6.37	25–34
Golf (amateur championships—English and American)	74	29.88	7.66	25–29

that many amateurs abandon amateur athletics before they have developed their greatest potential skill.* If this latter hypothesis is valid, it follows that we can discover man's potentially best years at sports and games only by studying the records of professional athletes.

The present study suggests that man's proficiency at such violent and vigorous activities as professional football and professional ice hockey wanes relatively early. These two activities require the players to make frequent and rather reckless bodily contacts. Activities of a less violent nature, such as professional golf, rifle and pistol shooting, corn husking, billiards, and bowling, can be participated in successfully at somewhat older age levels. These latter activities may be described as non-combative since they do not necessitate the pitting of one's strength against that of an opponent.

The foregoing data suggest also that, for certain measurable behaviors, the shape of the performance age curve varies both with the type of function that is measured and also with the excellence of the performance. Thus, if age curves are constructed for baseball performance of sand-lot quality, such curves would doubtless be flatter and broader than are the curves that are set forth in Figures 1 and 2. Both small boys and middle-aged men can participate successfully in sand-lot baseball. But when data for only major league performance are utilized, the baseball curves reveal relatively narrow

TABLE II

NUMBER OF OUTSTANDING PERFORMANCES PER FIVE-YEAR INTERVAL

Type of Activity	Age Interval										
	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69
Prof. baseball (not inc. pitching)	12	476	1,443	944	226	25					
Prof. baseball (pitching)	8	216	763	501	137	37					
Major league batting championships		9	51	31	5						
Major league pitching championships	1	17	41	26	3						
Major league stolen-base championships		13	33	16	1						
Professional boxers	6	142	208	75	14	3					
Tennis champions (Fr. Eng. and Amer.)	12	84	133	54	28	6					
Prof. ice hockey players	6	235	375	167	37	3					
Prof. football players		214	242	29							
Corn-husking champions	2	16	27	23	13	4	1	1			
Automobile racers	1	4	26	15	7		1				
Bowling champions (Ind. perf.)	2	5	13	18	12	6		1		1	
Bowling champions (Team perf.)	5	24	60	54	50	25	10	7	1	1	
Rifle and pistol shooters	33	95	153	137	97	82	20	5	7	1	
Duck pin bowlers (men)		4	25	37	22	3					
Duck pin bowlers (women)	1	17	43	29							
Billiards (world records)			5	15	12	5	5				
Billiards (world championships)	1	19	32	25	24	16	12	5	1		
Prof. golf (Eng. and American)		7	8	20	9	3			1		
Open golf (Eng. and American)	1	16	24	23	15	8	1				
Amateur golf (Eng. and American)	1	21	24	14	4	7	2		1		

peaks. Very superior baseball performance is thus exhibited over a narrower age range than is performance of lesser merit. And this latter statement seems to hold also for a number of other behaviors—for musical composition, for literary endeavor, and for certain kinds of scientific achievement.[1]

For several types of skill that have been cited in this article it has been possible to ascertain the one year (or age level) during which men are most likely to exhibit their best performance. For several other kinds of endeavor, it has been possible to determine only the three-, the four-, or the five-year interval during which championship skill is most likely to be displayed. For golf we have had to content ourselves (for the present) with a ten-year interval.* Some may wonder whether for most (or possibly all) activities of the kind that have been discussed in this article, there does not exist *one* year (or age level) during which groups of individuals will be most likely to exhibit their very best ability. The assembled data suggest, but they do not validate, this hypothesis. These data do demonstrate that, given sufficient time and coöperation, it will be possible to determine whether or not the fore-

*Data were assembled separately for 415 golfers who won either first or second place in amateur, professional, and open contests. The five-year interval of maximum proficiency was ages 24 to 28 inclusive. But, as has already been indicated, the ages of maximum proficiency vary with the type of golfing contest that is under consideration.

going hypothesis is a valid one. And, if valid, it will be possible to determine, for groups of individuals, which particular chronological age level, or fraction thereof, is most propitious both for the specific types of behavior that have been mentioned herein and for many others as well.

It seems obvious that, in much of the unorganized competition that is constantly taking place between the various age groups, some of the age groups are greatly handicapped, others of them are slightly handicapped, and some, perhaps only one, at any rate not more than a very few, possess a distinct advantage. And the keener the competition, the more valid, within limits, the foregoing statements. It seems likely that future generations of psychologists may be able to express these facts with mathematical precision. Indeed, it should be possible to construct, for each specific type of measurable behavior, of a given standard of excellence, something analogous to the mortality tables that have long been utilized by life insurance companies. Like the mortality tables, the probability tables that are here suggested would apply only to groups of individuals of a given chronological age. Such tables obviously would not apply to every individual within a given age group.

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The Behavior Pattern of Throwing and Some Observations Concerning Its Course of Development in Children

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THE PROBLEM

RESEARCH in the realm of child development has significantly entered the field of growth in motor behavior as basic to an understanding of all forms of behavioral development. Much is now known of the motor capabilities and their genesis and growth in the infant. How some of these continue their development in the play forms of childhood has not been systematically studied from the standpoint of neuromuscular changes in behavior. An attack on motor development from this angle seems timely.

It was an interest in the genetic foundations of throwing behavior, a common skill element in many play activities of childhood, which stimulated this study. Its main problem has been to determine how children of successive age levels use their bodies when they execute a hard overhand throw. The problem includes four specific objectives:

1. To study particularly the hard overhand throw as a special but commonly used type.
2. To discover age characteristics in manner of throwing.
3. To discover sex differences in manner of throwing.
4. In a general way to study the development of throwing behavior in children of ages two to twelve.

SOURCES OF DATA AND METHODS OF PROCEDURE

Thirty-two carefully selected children, a boy and a girl at each six months age level from two to seven years and at each year level from seven to twelve years, were the reactors. They were selected because each had achieved normal development in four significant phases of child growth, namely, physical, mental, motor, and personality development; all had a homogeneous home and school environment—one conducive to good health and a normal play life; all were right-handed. The children attended the preschools, elementary, and junior high schools of the University of Iowa. The professional courtesy to secure data at this University was most generously extended to the University of Wisconsin.

Extended preliminary observation of nursery school children in Madison, Wisconsin, aided in defining the problem, and served to de-

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termine the experimental procedure. The motion picture method of securing data was chosen. In a carefully arranged throwing field including distance scale marks and an electric clock (with intervals of 0.03 seconds), each reactor executed three hard overhand throws for filming.

The film was subjected to analysis by three methods: (1) film measurement to secure distances traversed by the ball in recorded time intervals; (2) translation of visual representations of a throw into verbal descriptions; (3) tracing of positions of body, arm, and hand at various stages of the throw. Three measures of objectivity of trial verbal descriptions were secured:

1. A percentage of agreement between the main descriptive items of five matched descriptions—94.1 per cent.

2. A percentage of agreement between all items—71.4 per cent.

3. A coefficient of correlation between the matched time readings of five throws—$+.98 \pm .004$.

The second result just stated definitely dictated that the final descriptions, in order to be highly objective data, must include every detail of movement observable in the film.

After carefully listing all movement items of each throw into an age list, movement features of the throw and their successive age patterns were revealed. The same procedure was followed for all the timing items of each throw. By a system of scattergramming these feature patterns, type patterns of the various phases of the throw, and of the whole throw itself, were determined. Each child's throw could then be classified as to type; also performance level scores could be obtained, both from the standpoint of movement and from the standpoint of timing.

RESULTS AND CONCLUSIONS

Treatment of the data has yielded the following results and conclusions.

1. Initial velocities of the hard overhand throw range from eight feet per second average for a two-year girl to seventy-five feet per second average for a twelve-year boy.

2. A feature common to the hard overhand throw is a release which starts the ball on a nearly horizontal path, regardless of age or initial velocity. The characteristic is more firmly established in the throws of older children and prevails in the throws of the older boys.

3. Each movement feature (forty-three in all) as well as each timing feature (nine in all) of the throw demonstrates an age series of patterns.

4. The age incidence of certain combinations of feature patterns suggests typical age patterns for arm, body, and whole throw. There were four demonstrated types of arm movement and five of body movement. These types were associated, however, in such a manner as to present six types of whole throw movement, of which only four are

clearly defined types. These types can be tentatively assigned to an age schedule and suggest a developmental sequence as follows:

Stage I is characterized by typical anteroposterior movements, of which there is a preliminary incipient stage with no body movement. This stage can be assigned to ages two to three or possibly up to four, and is described as follows: The reverse movement of the arm is either sideways-upward or forward-upward usually to high above shoulder, elbow much flexed. With this reverse arm movement the trunk extends with dorsal flexion of ankles and carries the shoulders back. The trunk then straightens, carrying the shoulders forward, and flexes forward with plantar flexion of ankles as the arm swings forward over the shoulder and down in front. Elbow extension starts early. Movements of body and arm are almost entirely in the anteroposterior plane over feet which remain in place; the body remains facing the direction of throw all the time; the arm is the initiating factor. There is trunk left rotation toward the end with the arm's forward reach.

Stage II is marked by the introduction of body and arm movements in the horizontal plane, as contrasted to the anteroposterior plane, and is assigned to ages three and one-half to five years. The whole body rotates right, then left above the feet; the feet remain together in place. The arm moves either in a high oblique plane above the shoulder or in a more horizontal plane, but with a forward downward follow-through. The elbow is much flexed; it may extend at once or later. The body changes its orientation and then reorientates to the throwing direction. The arm is the initiating factor.

Stage III marks the introduction of stepping; it is the right foot-step-forward throw, assigned to age five to six. The weight is held back on the left rear foot as the spine rotates right and extends; the arm swings obliquely upward over the shoulder to a retracted position with elbow much flexed. The forward movements consist of a stepping forward with right foot, unilateral to the throwing arm, with spine left rotation, early turning of the whole body to a partial left facing and trunk forward flexion, while the arm swings forward either in an oblique-above-the-shoulder plane or in a sideways-around-the-shoulder plane, followed by a forward downward movement of follow-through. Elbow extension does not start at once. This throw has both anteroposterior and horizontal features.

Stage IV is the left-foot-step-forward throw with trunk rotation and horizontal adduction of the arm in the forward swing. This throw is the mature form and all boys from six and one-half years up have it. The girls have, in most cases, attained the body and foot movements, but incompletely developed forms of the arm movement. Others show decided regressions or retardations.

5. The outstanding trend disclosed by the movement types is change from movements in the anterposterior plane to movements largely in the

horizontal plane, and from an unchanging base of support to a left-foot-step forward.

6. A constant in all throws is the unchanging orientation of the head.

7. Comparison of the girls' performances with those of the boys indicates sex similarity in the basic growth pattern of the age and sex differences in the performance level of that pattern.

8. The path the hand with ball takes changes from a very curved arc to a much flattened one, resulting from trunk rotation, arm horizontal adduction and late elbow extension.

9. Overlapping of features into chronologically adjacent types demonstrates emergence of one stage into the next.

10. The outstanding trend disclosed by the timing features is a progressively shorter period of acceleration of hand with ball and an earlier release. This trend attends the change in movement types.

11. Evidence points to the possibility that the arm action is largely responsible for the speed imparted to hand and ball.

12. The average acceleration of moving hand per second throughout the interval from the beginning of the forward swing to the release ranges from 18 to 1200 feet.

A short allusion should be made at this point to certain facts revealed by the timing data secured. A study of the path of the hand with the time intervals involved demonstrates in all cases a definite period of acceleration from the beginning of the forward swing, at which point the hand is practically at zero velocity, to the hand's farthest forward position, after which, during the follow-through, speed decreases. At some temporal point during this period of acceleration, the ball is released at a known velocity. The velocity at the time of release increases with age within each sex group. The oldest boy's velocity was 74.9 feet per second. The time interval of the forward swing from its beginning to the release grows progressively shorter with age or with movement types both in actual time and in proportional time. The actual time of this interval for the oldest boy's throw is 0.06 seconds. It is during this time that the acceleration resulting in the velocity of the ball at the release must be effected. Furthermore, the tracings of the path of the hand indicate that the acceleration in the path gets mainly under way when the elbow begins its extension and the arm begins to rotate inward, which in the best throws starts after the arm begins its forward swing and for the very best throw is a period of 0.03 seconds. There is sufficient evidence that the body movement does not assist in getting acceleration, but that it is a postural and orientating factor for a highly vigorous and rapid arm action. There is evidence, moreover, that the forward arm action characterized by horizontal adduction, starting from a much retracted position of the arm at shoulder level, is the type which has the shorter interval of time up to the release, brings elbow extension and inward rotation in late, imparts a high initial velocity, and must consequently have a very high average acceleration.

The computations show that the oldest boy's average acceleration throughout the interval is 1200 feet per second.

13. Four means of evaluating the throw have been diversely arrived at through the method of film analysis. They yield (1) velocity of the ball, (2) movement performance score, (3) timing score, (4) acceleration of the hand with ball. By assigning a rank to each and also to age within the entire group and within each sex group, comparisons can be made. The results expressed in rank order intercorrelations rank from $+.81\pm.043$ to $+.95\pm.012$ for the entire group; from $+.83\pm.055$ to $+.98\pm.007$ for the boys' group; and from $+.77\pm.072$ to $+.95\pm.017$ for the girls' group. In consideration of the fact that the movement scores, timing scores, and the velocities were each arrived at through entirely different sets of data, the above correspondence can be judged more than merely a coincidence.

14. Comparison of age rank with a final single score derived from the four evaluations suggests that the manner of throwing a hard overhand throw is a function of age. Correlations are $+.91\pm.022$ for the entire group; $+.92\pm.027$ for the girls' group; $+.97\pm.01$ for the boys' group. It should be stated that the above observations are made with reservations due to the nature of the data, which are characterized by the wide range of ages involved.

CONCLUSIONS INTERPRETED IN THE LIGHT OF ALLIED KNOWLEDGE

The features of change demonstrated in the sequential throwing patterns are kinesiological and physiological in nature. The trend is toward better mechanical means of projection and more advantageous timing, both of which contribute greater speed and a flatter arc.

The features of change correspond to many characteristics of development known to be present in other forms of growth.

Development of the basic pattern seems dependent upon the development of neuromuscular powers, as equilibration and orientation.

The development of a highly sensitive proprioceptive mechanism seems essential for the development of a basic pattern into an intricately timed activity.

Maturational factors are believed to be operative as the basic type patterns of throwing develop; learning, particularly after six years, greatly influences the skill pattern individuating out of and upon the basic growth stage; it may be the factor accountable for differences in performance, especially those so evident between the sexes.

The genetic history of the hard overhand throw and the panorama of change in the movement and timing features of successive stages in throwing behavior afford a valuable background for the solution of problems arising in respect to throwing plays and games of children—problems which involve program planning, provision for appropriate play space, allotment of time, methods of instruction, and group organization.

History of the Research Section of the American Association for Health and Physical Education

By H. Harrison Clarke
Syracuse University

EARLY INTEREST IN RESEARCH

PHYSICAL educators have been interested in research and in the scientific side of physical education since the early days of the profession in the United States. At the first meeting of the American Association for Health and Physical Education (then known as the Association for the Advancement of Physical Education) held on November 27, 1885, and at many of the subsequent early meetings of the Association, tests and the research techniques upon which they are based were considered as a vital force in physical education. At this opening meeting, Professor Edward Hitchcock of Amherst College, Chairman, presented a plan for scientifically determining physical education programs for individual students based upon a medical examination and physical measurements of the anthropometric type. The problem of uniformity in testing and application of averages or norms was discussed at great length, and this was followed by the appointment of a Committee on Statistics and Measurements, composed of Dr. Dudley A. Sargent of Harvard University, Dr. Edward Hitchcock of Amherst College, and Dr. William G. Anderson of Adelphi Academy, to study this problem.[1]*

This committee on anthropometry, and others of a similar nature which were subsequently appointed, played an important part in the meetings of the Association during the first twenty years of its existence. In 1895 a Committee on Anthropometry and Vital Statistics was reported as having conducted a program during the annual convention, with Miss Senda Berenson presiding and with Dr. Edward Hitchcock and Dr. Jay W. Seaver as the other members of the Committee.[2] A new Committee on School Anthropometry was appointed in 1897, composed of Drs. Bowditch, Porter, and Sargent, Miss Laure Fisher, and Mrs. Charles G. Ames. In 1903 a final Committee on Anthropometry was appointed with Dr. W. W. Hastings of the International Young Men's Christian Association Training School (Springfield College) acting as chairman, its report being given in 1905.[3]

Thus, it may be seen readily that at the initial meeting of this Asso-

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*Numbers refer to Bibliography at end of article.

ciation and during its early years a definite attempt was made to place physical education upon a scientific basis. However, it was not until 1925 that a Research Section became a definite part of the Association.

THE FORMATION OF SECTIONS

In the early days of the American Association for the Advancement of Physical Education, only general meetings were held at the conventions, it becoming an increasingly difficult task, as the Association grew and the variety of specialized interests increased within the profession, to find subjects that would appeal to more than a definite section of its members. The need became apparent for a change of both the type of organization for the Association and the type of program offered at the conventions. This led to prolonged deliberations over the revision of its constitution during the early nineteen hundreds, and resulted in the formation of sections as we now know them. The formation of sections as special interest groups was a vital factor in the growth of the Association, and permitted the ultimate affiliation of a Research Section, with autonomy of its own. Perhaps a brief summary of the changes during this period will make the transition that took place more meaningful.

The A.A.A.P.E. was originally patterned after the North American Turner-Bund which was founded a number of years before the Civil War, and which in 1893 was composed of over forty-two thousand members[4] with nearly four hundred local societies, at least one of which was located in almost every large city in the United States.[5] This large number of societies was logically distributed into districts throughout the country, individual membership depending upon affiliation with a local society. The A.A.A.P.E., on the other hand, had about six hundred members with only two districts and one section. In addition, the Turner-Bund was an association for general culture, in which education, music, and politics, as well as physical training and good fellowship, played an important part. The A.A.A.P.E. had for its object the single purpose of the advancement of physical education, as its name implied. This singleness of aim, and the confinement of membership to those who were teaching or who were interested in the cause of physical education restricted the membership, even though all the varying interests in the field were represented. Thus, inasmuch as representation at the national convention was based upon delegates from districts and societies, it literally disenfranchised half the members of the Association who were not attached to any district or local society—a very unsatisfactory situation.

Another criticism leveled by Sargent at the early organization of the A.A.A.P.E. was the need for greater representation of interests. This was a truly revolutionary suggestion which profoundly affected the future type of convention program. Basing his arguments on the experiences of the Boston Physical Education Society, which, in 1899, had

established special interest sections in anthropometry, medical gymnastics, public school work, and normal schools, Sargent suggested that the A.A.A.P.E. be divided into sections, as was then done, but instead of having these sections ascribed to different parts of the country, they be assigned to special interests in the field of physical education, each to be in charge of a chairman and secretary and to be responsible for its own program and activities. Thus was laid the groundwork for the section meetings as we now know them in our national and district conventions, permitting concentrated discussion of problems in small areas of the greater field of health and physical education.

Although Sargent made his original suggestion in 1900, it was not until April, 1903, that the new constitution was adopted,[6] which permitted the present type of expansion of both representation and interest within the Association—significant factors indeed, as they provided sufficient flexibility within the Association to allow for changing conditions through the years.

The idea of the section as a special interest group may have sprung from a method of committee reporting, probably used for the first time at the Tenth Annual Meeting, in April 1895.[7] At this convention, certain meetings were held under the direction of committees dealing with various subjects, such as: Committee on Anthropometry and Vital Statistics, Committee on Bibliography, Committee on the Dewey Decimal System of Classification of Books in Libraries, and Committee on Theory and Practice of Gymnastics. In the proceedings of the meeting, the committee programs were classed as "sections," as, for example, "Papers Presented before the Section on Anthropometry and Vital Statistics." The section meetings, however, were discontinued for a time, but were brought back in 1901 following the suggestions made by Sargent, which had received much favorable comment, editorially and otherwise, and which thereafter became a definite policy of the Association although not officially provided for in the Constitution until 1903.

A Section on Anthropometry, a first cousin to the Research Section, was held during these early meetings as a committee function but after the adoption of the new Constitution did not affiliate as a regular section of the Association, then known as the American Physical Education Association. This section, therefore, never did have official standing other than as a committee, holding its last meeting in 1906 at which time four societies had been organized and affiliated with the national association: the College Directors, Secondary School Directors, Public Schools, and the Therapeutic Section.[8] Two additional societies, the Normal Schools and the Society for Research, held some meetings but did not complete affiliation.[9]

The first national organization formed for the definite purpose of advancing research work in this country was the American Society for Research in Physical Education, which was organized in 1903 and held

its first annual meeting in April, 1904. All candidates for membership in this society were required "to present either published studies along physical education lines, or a thesis ready for publication, setting forth such studies." [10] The officers were: Dr. Theodore Hough, President; Dr. George W. Fitz, Secretary; and Drs. George L. Meylan, Thomas A. Storey, Fred E. Leonard, James H. McCurdy, and Thomas D. Wood, members of the Executive Committee. Meetings of this Society were held until 1906 in conjunction with the national conventions of the American Physical Education Association, after which time it seems to have gone out of existence, due perhaps to the fact that requirements of admission to the Society were too stringent, or that it was superseded in 1907 by another national research society which was to become a vital force in physical education during the next twenty years.

THE ATHLETIC RESEARCH SOCIETY

The Research Section can actually trace its origin to an organization known as the Athletic Research Society, which held its initial meeting in December, 1907, but did not affiliate with the American Physical Education Association until 1925. The inspiration for the organization of this society was due, as were many other forward-looking movements of that time, to the influence of Dr. Luther H. Gulick.[11] The initial meeting was held at the Faculty Club of Columbia University, and was attended by a group of men concerned with athletics for boys in elementary schools, secondary schools, colleges, Young Men's Christian Associations, and boys' clubs.[12] The names of the men attending this meeting sound very much like an honor roll of famous pioneers in our profession, including: Clark W. Hetherington, Luther H. Gulick, George L. Meylan, George J. Fisher, Dudley A. Sargent, E. B. De Groot, James H. McCurdy, Alonzo A. Stagg, Lee Hanmer, James A. Babbitt, F. B. Barnes, C. Ward Crampton, H. L. Curtis, William Orr, Capt. Palmer Pierce, Joseph E. Raycroft, J. H. Scott, and Myron T. Scudder. Clark W. Hetherington of the University of Missouri was selected as the first Chairman, although Dr. Luther H. Gulick was elected Temporary Chairman for this first meeting, and Lee F. Hanmer of the New York Public Schools was made Secretary, both men holding these offices for a number of years. Dr. Joseph E. Raycroft of Princeton University was elected Secretary in 1910, a position he held until December 31, 1919, when Professor Elmer Berry of Springfield College became the incumbent. Other presidents of the Society included such men as Luther H. Gulick, W. P. Bowen, James H. McCurdy, George J. Fisher, A. K. Aldinger, F. E. Leonard, Daniel Chase, and R. K. Atkinson.

The Athletic Research Society was a vital force in physical education during the period of rapid athletic expansion in the United States prior to the World War, having as its function the study of athletic problems, including the educational, social, and moral forces involved,

with a view to making recommendations for their solution. In a period when athletic abuses were rampant throughout the land, this Society stood, as an organized body of influential men, for high ideals in sport and vigorously promoted a campaign against commercial and professional influences. The organization in its meetings and in its special studies was directed along lines that led to a better and more general understanding of the fundamental value for adolescents of an experience in competitive athletics, and in the formulation of plans that would define an ethical basis upon which amateur sport could be conducted with the greatest moral and physical profit to the participant.[16]

A very considerable amount of work was done by individuals and committees in investigating the conditions which influence the spirit that dominates competitive games and play life in general throughout the country. Two great problems were attacked early: that of an adequate form for administering and controlling amateur sport in the United States, and the general problem of amateurism. Committees were also appointed to investigate special problems such as: the definition of an amateur; an honor code for competitive sport; the effects of competition on the individual; a schedule of athletic work for boys and girls of different ages; the promotion of the cause of physical education through the U.S. Bureau of Education; health and morals in athletics; the philosophy of sport; and minimum tests for health examinations. Many of these reports contain as thorough and realistic an analysis of the functions, values, and dangers of amateur athletics as can be found anywhere, and constitute important milestones in the development of physical education in the United States.

As the Athletic Research Society was composed of educators interested in the scientific study of athletic problems from a national standpoint, it became apparent early that discussion of these problems by a relatively small group, however representative it might be, was not sufficient to meet the situation adequately. An effort was made, therefore, to make this work more effective by the creation of a federated committee. This committee was formally organized on December 27, 1911, being composed of officially appointed representatives from national organizations interested in play and athletics, and having the officers of the Athletic Research Society, ex officio: Dr. Hetherington as the first Chairman, and Dr. Raycroft as the first Secretary. The function of the Federated Committee was to "unite the national organizations interested in play and recreation in a comprehensive educational campaign to develop wholesome play sentiments among the youth of the land, and to widen the public consciousness of the moral and social values of play and athletics and to determine and seek to put into operation the best forms of administration." [12] An underlying reason for the existence of this committee was to combat the A.A.U.-dominated American Olympic Committee,[13] a great deal of effort being directed toward obtaining

a better relationship between the A.A.U., the Y.M.C.A. athletic leagues, and the National Collegiate Athletic Association. In a sense, too, its purpose was more or less political in that it tried to get some kind of adjustment in the athletic "wars" that were then going on.[14] This Committee led a more or less attenuated existence for a number of years, dropping out of the picture when the American Olympic Committee expanded on a broader basis of representation.[15]

The decade following the World War saw a great increase in the emphasis placed on athletics and physical education, and a definite change in the type of problems faced by the profession. At the beginning of this period, the Athletic Research Society began a discussion of the new problems growing out of the War, and its committees studied such problems as: the post-war program of physical education, the nation's strength and weakness as shown by the war, a nation-wide required physical education system, the need for national and state physical education laws, training teachers of physical education, state certification requirements, the administration of intramural athletics, and methods of measuring motor efficiency. An awakened interest in the relationship between physical education and the medical profession was clearly evidenced, indicating a swing in thinking toward a definite consideration of the broader field of health and physical education. The Society moved forward with its pre-war plan of conducting studies on problems related to athletics, but now expanded to include certain broad aspects of physical education, and, although the Federated Committee no longer existed, of setting up machinery for putting its recommendations into active and effective operation.

The usefulness of the Athletic Research Society, however, was nearing its end, and it was not long before its effectiveness began to decline. Two major factors contributed to this end, the first being that other organizations were taking over many of the problems dealing with athletics. With the increased emphasis placed on athletics following the World War, a large number of national organizations dealing with athletics sprang up, and with certain of the older ones, became extremely active. Their meetings were held each year during the Christmas holidays, as were those of the Society since its beginning in 1907. These Christmas meetings were, and always had been, of a predominantly athletic nature, so with the deliberations of the Society turning away from purely athletic problems, the interest in these meetings began to fall off, the National Amateur Athletic Federation largely taking its place.[17]

A second reason for the decline of the Athletic Research Society was that a duplication of effort between its committees and those of the American Physical Education Association began to appear. The A.P.E.A. had always cooperated with the Society in publishing the proceedings of their meetings and the reports of their committees. Dr. J. H. McCurdy, secretary of the A.P.E.A. and editor of the *American Physical Educa-*

tion Review from 1906 to 1929 inclusive, was also a past president and an active participant in the work of the Society. Consequently, when the Society cast about for kindred spirits with whom to associate, the A.P.E.A. was ready to welcome them. The fact that the work of the two organizations was of a similar nature, both being interested in the same problems, was readily recognized and an amalgamation easily arranged.

Affiliation did not take place immediately, however, but representatives of the Society began attending the meetings of the National Council of the A.P.E.A. In 1920, Dr. Raycroft attended the meeting as a representative of the Athletic Research Society.[18] In 1922, Martin I. Foss, at a meeting of the Council, called attention to the need for increased committee work by the Association and raised the question whether the Athletic Research Society might not desire to affiliate with the A.P.E.A., thus giving greater continuity to the committee work which was along similar lines.[19] Daniel Chase, new president of the Athletic Research Society, attended the meeting of the National Council in 1923.[20] Also in this year, the Society held a meeting in conjunction with the National Convention of the A.P.E.A. at Springfield, Massachusetts, in conformity with suggestions previously made at the annual meeting of the Society in New York.[21] This meeting appeared as a section meeting on the A.P.E.A. program. In 1924, both the president, Daniel Chase, and the secretary, Elmer Berry, represented the Athletic Research Society at the National Council meeting, at which time the possibility of the Society becoming a section of the A.P.E.A. was discussed, although definite action was postponed pending the decision of the Society at its next annual meeting.[22]

Definite affiliation of the Athletic Research Society with the American Physical Education Association did not take place until the meeting of the National Council in 1925.[17] The place of the Society in the Association was not clearly defined at this time. Dr. McCurdy suggested that it might become an Athletic Section, sometimes meeting with the Men's or Women's Sections, and sometimes separately as before. It was finally decided, however, that the Society be admitted and allow matters to adjust themselves. In 1926 Dr. McCurdy reported that the Society had decided to become a Research Section.

THE RESEARCH SECTION

The period of transition of the Athletic Research Society to the Research Section of the American Physical Education Association was a difficult one, requiring three additional years to complete. At first, the Society maintained its former organization and name, and looked forward to renewing the Christmas meetings with complete autonomy. Elmer Berry, who resigned as secretary in May, 1927, upon accepting a position as director of the International Y.M.C.A. School of Physical Education in Geneva, Switzerland, wrote the new secretary, James E.

Rogers, that he hoped it would be possible "to resurrect the Society, inject some adrenalin," and make it fill the place he felt was possible.[23] The last Christmas meeting, however, was held on December 28, 1927, and was attended by R. K. Atkinson, President, James E. Rogers, Secretary, Ethel Perrin, Dr. W. A. Burdick, Dr. C. H. McCloy, and George B. Affleck, marking an important milestone in the history of the Research Section.[24] The task faced by this group of leaders was to gear the Athletic Research Society to function as the Research Section of the A.P.E.A., to give it prominence and prestige in the larger organization, and to develop types of programs that would attract a large attendance. The success of this undertaking is plainly evident in the present wide-spread interest in the Section and in the cause of research in physical education.

The year 1928 marks the official beginning of the Research Section as we now know it. At the Baltimore Convention, the Section held a luncheon meeting in connection with the Alumni, R. K. Atkinson presiding, at which J. E. Rogers spoke on "The High Spots in Physical Education Research." Following the luncheon, the Athletic Research Society—the last time this title was used—met, and heard the following papers: "Report on Physiological Research Relating to Circulation," Wilbur P. Bowen, Director, Department of Physical Education, Michigan State Normal College, Ypsilanti, Michigan; "History and Progress of Measurements in Physical Education," C. H. McCloy, Secretary for Research in Physical Education, National Council of the Y.M.C.A., New York.

The following strong slate of officers was elected: President, Dr. F. R. Rogers; Vice-President, Agnes Wayman; Secretary-Treasurer, C. H. McCloy. Executive Committee: George B. Affleck, Springfield College; R. K. Atkinson, New York City; V. K. Brown, Chicago; Dr. W. A. Burdick, Maryland; Daniel Chase, Sportsmanship Brotherhood; Dr. F. W. Cozens, Los Angeles; Dr. Charles H. Keene, Buffalo; F. B. Messing, Tennessee; Prof. J. B. Nash, New York University; N. P. Neilson, California; Ethel Perrin, American Child Health Association; J. E. Rogers, National Physical Education Service; Dr. A. H Steinhaus, Y.M.C.A. College, Chicago; and Dr. J. F. Williams, Columbia University.

The Executive Committee immediately defined the functions of the Section to be as follows:

1. To serve as a clearing house for those undertaking projects in the field of physical education or health.

2. To give advice in research techniques and methods of approach in problem solving.

3. To pass upon research publications and to offer such cooperation with the writers of such papers as may be desired to render them most suitable for publication.

4. To promote informal groups of research workers in various centers

for the purpose of study of the research field and mutual cooperation.

5. To secure suitable material for its programs at the annual meeting, and to render assistance to the executives of other sections who may desire to know of research conducted in their respective fields.

6. To promote cooperative research particularly in the field of tests and measurements in physical education.

7. To call to the attention of physical educators from time to time significant tools which have already been developed by research in physical education.[27]

From this point on, the development of the Research Section went forward rapidly, until today it is one of the strongest and best attended of any of the sections of the American Association for Health and Physical Education. Section meetings are now held at all but one of the district conventions, and at the national convention as before. The Midwest District held the first organization meeting at a dinner in 1930, and the Southwest District completed its organization in April 1937.* In 1928, two papers only were read at the National Convention; in 1930, a total of eight papers were read at the National and Midwest Conventions; and, in 1934, the all-time high of forty-nine different research papers were presented at the various meetings of the Association throughout the country. Reports of approximately forty studies in health and physical education have been given annually at Association meetings during the past several years. The type of studies upon which reports have been given cover the entire range of research in health and physical education and allied fields.

At the present time the Research Section is undergoing a process of reorganization in order to expedite the preparation of convention programs. Upon the instigation of Ruth B. Glassow of the University of Wisconsin, a Committee on Reorganization, composed of Dr. E. C. Davis, Gertrude Baker, Dr. Frederick W. Cozens, Dr. Arthur H Steinhaus, and Ruth Glassow, Chairman, was appointed at the St. Louis Convention in 1936 to submit a plan which would eliminate the immense amount of correspondence falling on the chairman in the preparation of convention programs, and which, by a more adequate exchange of ideas, might prove more helpful to all members of the Association interested in research problems.[28,29] About this time also, Dr. C. H. McCloy, then President-Elect of the A.A.H.P.E., wrote to all chairmen of national sections urging them to organize their sections for continuous action throughout the year, rather than merely for providing programs at national meetings.

At the New York Convention in 1937, definite steps were taken to perfect a stronger organization for the Section by establishing an Executive Board of nine members, in addition to the Section chairman and secretary, six of whom were to represent the six districts of the Associ-

* In the Appendix will be found the years since 1928 when the meetings of the Research Section have been held at the national and district conventions, together with the chairman for each year.

ation, the remaining three to represent various types of research in health and physical education. At the regular meeting of the Research Section, the Board members were elected as follows: Mrs. Theresa Anderson, Dr. D. K. Brace, Dr. C. L. Brownell, Dr. F. W. Cozens, Ruth Glassow, Professor T. K. Cureton, Dr. H. H. House, Dr. A. H Steinhaus, and Dr. E. C. Davis. In addition, Dr. Harlan G. Metcalf was elected chairman of the Section, and Dr. R. E. Quimby, Secretary.[30] This Executive Board met during the Convention to discuss plans for the future, the consensus of opinion being that for the present its major function should be to assist the new chairman each year in discovering research studies that should be reported at Section meetings, and that other matters should be left for consideration at future meetings of the Board. Dr. C. L. Brownell was elected chairman of the Board by a mail vote in November, 1937.

Another committee that may prove an effective force in the future of the Research Section is the Research Committee of the Legislative Council of the A.A.H.P.E. which was appointed at the Council meeting of April 21, 1937, and which is composed of Dr. Delbert Oberteuffer, Dr. Frederick W. Cozens, Dr. E. Benton Salt, and Dr. Frank S. Lloyd, Chairman.[33,34] The purpose of this committee is to gather together systematically the titles of research studies in the field of physical education, health, and recreation, and to classify them under functional heads in order to indicate the strengths and weaknesses of research in this field. Another of their proposed functions will be to keep the Research Section informed of the recent developments in research throughout the country.[35]

CONCLUSION

With the development of the Research Section has come a greater knowledge of and interest in the science of health and physical education by members of the profession, a condition that has been abetted by the publication of the *Research Quarterly* since 1930 and the phenomenal growth in graduate study in this field at our colleges and universities.[36]

SOURCES FOR THE STUDY

The main bibliographical sources for this study have been the following:

A. Reports and minutes of meetings of the Legislative Council of the Association, 1885 to date.

B. Historical articles, official announcements, and news notes appearing in:
   a) *Proceedings of the Association for the Advancement of Physical Education*, 1885 to 1895.
   b) *American Physical Education Review*, 1896 to 1929.
   c) Proceedings of the Athletic Research Society, 1907–1921. (Many of these were published in the *American Physical Education Review*.)
   d) *Journal of Health and Physical Education* and the RESEARCH QUARTERLY, 1930 to date.

C. Correspondence with past secretaries of the Athletic Research Society, national and district chairmen of the Research Section, and the central office of the American Association for Health and Physical Education.

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APPENDIX

Meetings and Chairmen of the Research Section at National and District Conventions of the American Association for Health and Physical Education since 1928

National

1929 F. R. Rogers, New York State Division of Physical Education.
1930 C. H. McCloy, University of Iowa.
1931 Arthur H Steinhaus, The Y.M.C.A. College, Chicago.
1932 C. L. Brownell, Teachers College, Columbia University.
1933 Eugene C. Howe, Wellesley College.
1934 Ruth Glassow, University of Wisconsin.
1935 J. H. McCurdy, Springfield College.
1936 F. W. Cozens, University of California at Los Angeles.
1937 Elwood Craig Davis, Pennsylvania State College.
1938 Harlan G. Metcalf, George Peabody College.

Midwest

1930 A. H Steinhaus, Y.M.C.A. College, Chicago.
1931 C. H. McCloy, University of Iowa.
1932 Elizabeth Halsey, University of Iowa.
1933 C. H. McCloy, University of Iowa.
1934 Mabel Rugen, University of Michigan.
1935 A. H Steinhaus, George Williams College.
1936 Ruth Glassow, University of Wisconsin.
1937 J. P. Trepp, Ohio University.
1938 Vern Hernlund, George Williams College.

Eastern

1931 George B. Affleck, Springfield College.
1932 C. L. Brownell, Teachers College, Columbia University.
1933 H. Leigh MacCurdy, Yonkers, N.Y.
1934 Frank S. Lloyd, New York University.
1935 J. H. McCurdy, Springfield College.
1936 E. C. Davis, Pennsylvania State College.
1938 Walter A. Cox, Albany, N.Y.

Southern

1934 David K. Brace, University of Texas.
1935 David K. Brace, University of Texas.
1936 R. C. Quimby, Berea College.
1937 R. C. Quimby, Berea College.
1938 Anne S. Duggan, Texas State College for Women.

Central

1934 W. W. Tuttle, University of Iowa.
1935 W. W. Tuttle, University of Iowa.
1936 Granville B. Johnson, University of Denver.
1937 Granville B. Johnson, University of Denver.
1938 Vernon W. Lapp, University of Kansas.

Southwest

1938 J. W. Coleman, University of Nevada.

Professional Training in Health Education

By Mary Gross Hutchinson
Professor of Physical Education
University of Washington
Chairman of Committee for the Western Society of College Departments

At the 1936 meeting of the Western Society of College Departments of Physical Education, a paper on some of the aspects of health instruction was presented by Dr. Morris of Oregon State College. An interesting discussion followed with the result that a committee was appointed by the President on Professional Training in Health Education, including Nadine Cragg, University of Redlands; Maud Knapp, Leland Stanford University; Laura McAllister, Oregon State College; Mary Gross Hutchinson, University of Washington. Dr. Edna Bailey, University of California, and Fannie Shaw, State Department of Health, Georgia, were also asked to assist in the study.

The committee was allowed to determine and to define its problem and to establish its own procedures. They felt they could not assume responsibility for a study of professional training in health education in all its aspects, and there was no indication from the Society that such a comprehensive study was desired. Consequently the selection of a particular phase was their first problem.

The scope, extent, responsibilities, and ramifications of the school health program have not as yet been adequately defined to the complete satisfaction of all involved or concerned. Increased responsibility on the part of the school administrators, rapidly increasing personnel in many phases of the school and community program, and the accentuated interest of federal, state and municipal agencies have all given impetus to the program. Re-evaluations of curricula have revealed the need for emphasis on the truly functional subjects, and health instruction has, for the first time, in many schools come into its academic own. The community health program no longer exists as a separate entity in itself—it can be complete only as the school program is an integrated part thereof.

Interesting illustrations are the appointments of directors of health education in the state departments of health. A state public health program can be complete only as coordination is effected through the established state educational agency, the school. In one state a State Planning Council, created by legislative act to develop long-term planning for the development of the state's resources, has been concerned

in its Public Health Committee with the development of the school health program as a part of the state health program. There are many instances in both urban and rural communities of joint responsibilities by community and school in certain phases of the health program.

A milestone in the history of health education was passed when the Committee on Terminology appointed by the American Physical Education Association defined terms and fields of activity—namely, health service, health environment, and health instruction. Another milestone was passed with the reorganization into the American Association for Health and Physical Education.

In spite of these developments, however, it must be confessed that to the idea and ideal—*Health* and Physical Education—we in physical education have often given only lip service. Many reports of important and significant health conferences have been amazingly devoid of even physical education representation.

This rapidly growing and expanding program in the school has given rise to several pertinent questions. What does a good school health program look like? What goes on? By whom are its various phases directed? What kind of people should they be? What do they do? It is with some of these questions that the director of professional training in physical education is concerned.

Consequently, the committee has taken as its specific problem—what should be the professional training in health education for the professional physical education student? It is not concerned with professional training for those engaged in such phases as are represented by the school nurse, school physician, or the teacher who is the teacher in health instruction only (as distinguished from the teacher who has a partial responsibility in this field.)

The committee was concerned less with what is actually being done than with what should be done, that is, a picture of professional training at a particular chronological moment which showed where we were was considered of less value than one which showed where we should be going.

As a springboard into the sea of current professional curricula, the list of health education courses as stated in the Report of the National Committee on Standards of Professional Training was used. That there would be unanimous agreement on these statements was hardly to be expected; however, it did seem the best available up-to-date list.

This list included nine courses which were rearranged in accepted terms of phases of the school health program. Each member of the committee listed under each course her conception of desirable subject matter and activities. These were summarized and translated into specific activities in a school program. While it might be difficult to secure opinion or agreement on courses as courses, agreement on what

teachers could be expected to do should not be so difficult. At the same time each member submitted a list of those leaders, both in the field of professional education and related fields, whose opinions would be of value.

The following questionnaire was the result and in this form was used for the study.

PROFESSIONAL TRAINING IN HEALTH EDUCATION

Health Service Program

Health Examination

As a { Director of professional training / School administrator / Physical education supervisor }

I expect the physical education teacher to be able to:	Yes	No	Comments
1. Develop desirable attitude toward examinations.	.....	.....	.....
2. Assist in giving specific parts of examinations such as height, weight, etc.	.....	.....	.....
3. Use for basis of classification of pupils in physical education activities.	.....	.....	.....
4. Develop desirable attitudes toward correction of defects.	.....	.....	.....
5. Cooperate with community agencies in follow-up program.	.....	.....	.....
6. Work with school physician in interpreting health record to pupil.	.....	.....	.....
7. Work with school nurse in interpreting health records.	.....	.....	.....
8. Assist in selecting pupils who need to be referred to physician (especially when his time is limited).	.....	.....	.....
9. Know how to assist school administrator in securing aid from community health agencies (such as county nurse, etc.).	.....	.....	.....

Healthful School Environment

I expect the physical education teacher to:	Yes	No	Comments
1. Know the accepted standards in all phases of the school environment (such as ventilation, lighting, etc.).	.....	.....	.....
2. Know how to cooperate with school personnel in developing a program based on these standards.	.....	.....	.....
3. Develop desirable attitudes among pupils toward these standards.	.....	.....	.....
4. Know the basic facts in control of disease.	.....	.....	.....
5. Develop desirable attitudes toward immunization, quarantine, etc.	.....	.....	.....
6. Practice the elements of healthful school living in the school program (i.e., in all aspects related to the conduct of physical education activities).	.....	.....	.....
7. Know the facts relating to accident prevention.	.....	.....	.....
8. Practice accident prevention in conduct of activities.	.....	.....	.....

Health Instruction

As a { Director of professional training / School administrator / Physical education supervisor }

	Yes	No	Comments
I expect the physical education teacher to			
1. Know the basic facts in subject matter in health teaching (as summarized from the White House Conference on Child Health and Protection).			
A. Food habits and food.	.....	.....	.....
B. Control of disease.	.....	.....	.....
C. Safety program.	.....	.....	.....
D. Mental hygiene.	.....	.....	.....
E. Physiology.	.....	.....	.....
F. Sanitation (community hygiene).	.....	.....	.....
G. Alcohol, tobacco, narcotics, drugs, etc.	.....	.....	.....
H. Clothing.	.....	.....	.....
I. Selection of medical advisor.	.....	.....	.....
J. Posture.	.....	.....	.....
K. Sex education (education for parenthood).	.....	.....	.....
2. Know how to select and analyze subject matter for different groups; e.g., according to age grade level and other school classifications.	.....	.....	.....
3. Know how to select, evaluate, and use textbooks.	.....	.....	.....
4. Know how to select, evaluate, and use other health materials.	.....	.....	.....
5. Know how to select and use health tests.	.....	.....	.....
6. Know how to plan and build a curriculum for different school groups (i.e., grade or other school classifications).	.....	.....	.....
7. Know how to use and study the school environment for health teaching.	.....	.....	.....
8. Know how to use community health agencies in the health teaching program.	.....	.....	.....

Professional Training in Health Education

As a { Director of professional training / School administrator or supervisor / Physical education supervisor }

I believe that a physical education teacher in her professional training should have:

	Essential	Desirable	Of Little Value	Additional Comment
1. Participated in or observed the giving of health examinations in a school situation.	.....	.....	.....	.....
2. Had the opportunity to follow up cases to see relation and coordination among school personnel.	.....	.....	.....	.....
3. Contacted at least one community health agency to observe relation to school health program.	.....	.....	.....	.....
4. Studied in a school situation one phase of the school environment (ventilation, lighting, safety measures, etc.).	.....	.....	.....	.....

5. Studied a certain number of school health records. ....
6. Done practice teaching in health instruction in an elementary school. ....
7. Done practice teaching in health instruction in junior or senior high schools. ....

Institution .....
Name .....
Official position or title.....

The questionnaire was sent to fifty leaders in the fields of professional training, school administration, and physical education supervision. While there may seem to be undue weighting in the professional training group, the fact should be recognized that many in this group have been both school administrators and supervisors. The interest in the study was evidenced by replies from forty-eight out of the fifty; seven replied with letters clarifying further their ideas, all of which were most valuable.

The summary of the report is as follows:

HEALTH SERVICE PROGRAM

Health Examination.—Replies to this section of the questionnaire showed the following:

Checked "yes" by all administrator and supervisor groups.

Checked "yes" by all except one of directors of professional training group, with the following comments:

a) Cooperation with health agencies usually better done by school nurse.

b) Experience necessary to assist school administrator.

c) All items expected of *all* teachers in school.

d) Assistance in securing aid from community health agencies especially important in rural communities.

Healthful School Environment.—Replies to this section of the questionnaire showed the following:

Checked "yes" by all administrator and supervisor groups.

Checked "yes" (with exception of one) by all directors of professional training group with following comments.

a) Five checked "no" on item 1 and added statement "should know authoritative sources."

b) Several added that all items were expected of *all* teachers.

c) Two stated item 6 especially important.

Health Instruction.—Replies to this section showed the following:

Checked "yes" by all except one of administration and supervisor groups.

Comments:

a) Supervisor who checked "no" on 2–8 doubted whether the physi-

cal education teacher could include this in his professional training program.

b) Doubt expressed by one regarding sex education.

Checked "yes" by twenty-eight out of thirty-six directors of professional training groups.

Comments:

a) Three who checked "no" stated this was health education, not physical education.

b) Two stated items 2 to 6 were not practical.

c) One stated items 2–6 only after much experience.

d) One stated items 2–8 were a specialized function and consequently not expected of physical education teachers.

e) One stated items 2–8 should always represent cooperating groups or committee.

Professional Training in Health Education.—Replies to this section showed the following:

1. "Participated in or observed the giving of health examinations in a school situation." Checked essential by all in administrator and supervisor groups. Checked essential by twenty-seven, desirable by seven in director of professional education group.

2. "Had the opportunity to follow up cases to see relation and coordination among school personnel." Checked essential by seven and desirable by three of administrator, supervisor groups. Checked essential by seventeen, desirable by eighteen, of no value by one of directors.

3. "Contacted at least one community health agency to observe relation to school health program." Checked essential by five, desirable by four of administrator, supervisor groups. Checked essential by eleven, desirable by twenty-three of directors of professional education group.

4. "Studied in a school situation one phase of the school environment (ventilation, lighting, safety measures, etc.)." Checked essential by seven, desirable by three of administrator, supervisor group. Checked essential by fifteen, desirable by seventeen, of no value by two directors of professional education group.

5. "Studied a certain number of school health records." Checked essential by seven, desirable by two, of little value by one of administrator, supervisor group. Checked essential by seventeen, desirable by fourteen of directors of professional education group.

6. "Done practice teaching in health instruction in an elementary school." Checked essential by six, desirable by four of administrator, supervisor group. Checked essential by thirteen, desirable by twelve of directors of professional education group.

7. "Done practice teaching in health instruction in junior or senior high schools." Checked essential by eight, desirable by two of adminis-

trator, supervisor group. Checked essential by nineteen, desirable by twelve of directors of professional education group.

Additional comments:

The statement was made by several that certain phases of professional training should be on the graduate level. This seems thoroughly consistent with the trend to extend professional teacher training to five years for state certification.

The study purposely avoided the question as to who is responsible for the health education program in its entirety. Dr. Williams' statement, however, is especially clarifying: "Health education is a special field, but physical education personnel should be informed and cooperative." These informed and cooperative functions are illustrated by sections 1 and 2. "In health instruction *all* teachers should be informed on item 1. Items 2 to 8 are specialized functions of the health education specialist."

CONCLUSIONS

1. Agreement on all items relative to health examinations is practically complete. Techniques in use of examinations and cooperative functions relative to them, are stressed with much emphasis on the latter.

2. In connection with healthful school environment the interesting factor is not only practically complete agreement, but the added emphasis on the need for all teachers. This places a direct responsibility on professional physical training departments relative to training of *all* teachers.

3. The situation relative to health teaching seems to be:

a) A feeling for the need of more preparation than is now required of the professional student in physical education.

b) A trend toward recognition of health teaching as a teaching subject, i.e., the recognition of a health teaching minor or major.

4. In an effort to determine some of the additional factors of professional training all the items were agreed to be either desirable or essential. The particular item of practice teaching seems important.

5. It would seem that if the name health and physical education represents both an idea and an ideal, such emphases as are herein indicated may serve as guides in professional training.

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The Effect of Exercise, Fatigue, and Exhaustion on the Electrical Potential of the Brain Cortex and Threshold of the Knee Jerk

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IT IS known that as long as an animal is alive, nerve impulses pass to the brain over sensory nerves, and from the brain over motor or efferent nerves to the outlying organs and muscles. We have presented evidence which would seem to indicate that the electrical potential of the brain cortex, or surface, is at any instant determined by the balance between these incoming and outgoing negative charges or nerve impulses.[1]* If the incoming charges are in excess, the brain gains negative charges and, as a result, becomes more electro-negative. If, on the contrary, the outgoing charges are in excess, the brain loses negative charges, and, as a result becomes less negative, and may even become electro-positive under certain conditions, such as in surgical anesthesia.[2]

It is known that during physical work or exercise, negative charges or nerve impulses pass from the motor area of the brain out over motor nerves to the voluntary muscles and cause them to contract. One object of this investigation was to determine if the loss of these negative charges from the motor area during exercise would affect the electrical potential of the motor cortex. The other object was to determine if the loss of negative charges from the periphery coming in over sensory nerves to the brain would affect the electrical potential of the outlying structures of the body, and hence their irritability. For this purpose, the effect of physical work or exercise on the threshold of the knee jerk was studied.

EFFECT OF MODERATE EXERCISE, FATIGUE, AND EXHAUSTION ON THE ELECTRICAL POTENTIAL OF THE BRAIN CORTEX

One non-polarizable electrode was placed on the forehead of the subject, as near over the motor area of the brain as the receding of the hair of the scalp would permit, and the other electrode on some outlying

* Numbers refer to Bibliography at end of article.

part such as the arm or leg. These electrodes were then connected by means of wires to a moderately delicate galvanometer, as shown in the insert in Fig. 1. When this was done it was found that an electric current passed between the head and the arm or leg, as was indicated by a deflection of the beam of light on the galvanometer scale. The strength of this current was found to differ for different individuals and to increase with exercise and decrease with rest.

The curve in Fig. 1 shows the effect of exercise and rest on the amount of current passing between the head and the arm in a typical, healthy, young, vigorous, male university student (ELB) age 20 years, weight 180 pounds. Prior to taking exercise the subject had been lying down asleep and resting. Under these conditions of rest the strength of the current had decreased so that the beam of light oscillated only two or three divisions on the galvanometer scale. Each scale division represents 0.025 micro-amperes of current. Upon arising and taking exercise which consisted of 5 floor dips, the strength of the current was increased, as was indicated by a deflection of 17 divisions on the galvanometer scale; 10 floor dips increased the deflection to 25 divisions, and after taking 15 floor dips the beam of light swung past the 25th division and off the galvanometer scale. It may be seen further in the chart that upon resting for ten minutes the current decreased to its original strength, as was indicated by two divisions of deflection on the galvanometer scale.

The effects of several other kinds of exercise, such as wrestling, running, basketball, etc., were tried, and, like the floor dips, were found to increase the strength of the electric current, which was followed by a decrease with rest. It was also found that if the exercise was continued to fatigue, the strength of the current was decreased, and if pushed to the point of exhaustion, there was a reversal in the direction of the current. Fifteen floor dips, for example, produced a marked increase in the strength of the current in this particular subject; 28 floor dips decreased the strength of the current, and 38 dips caused a reversal in the direction of the current.

Similarly, wrestling to exhaustion produced a reversal in the direction of the current in most of the contestants, but in some it produced only a decrease in the strength of the current. The following is typical in our experiments. Two men wrestled until they were tired and ready to stop. At the beginning of the wrestling there was produced a large increase in the strength of the current in both wrestlers, which was followed by a decrease with the onset of fatigue, and in most instances, there occurred a reversal in the direction of the current in both wrestlers at the end of the contest, when both were very tired. In certain cases, however, the direction of the current would be reversed in one wrestler, and only slightly decreased in the wrestler who was pitted against him. When an experienced wrestler wrestled an inexperienced one, there

was produced at first a rise in the negative potential of the brain cortex in both, but as the wrestling progressed, the decrease in the negative potential, as well as the reversal in polarity, came on more quickly in the inexperienced than in the experienced wrestler.

Whether or not the different strengths of electric current produced in these different wrestlers are an index to their physical fitness or ability, our experiments so far do not show conclusively. We have found, however, that exercise produced a relatively small increase in the strength of the current in elderly people, and even this small increase was quickly followed by a decrease with further exercise, in keeping with the fact that elderly people are unable to take much exercise, fatigue quickly, and recuperate slowly. An old person is like an old, worn out battery which takes charge with difficulty and loses its charge readily with use. A younger person in good physical condition, on the contrary, like a good battery, charges up quickly and easily on taking exercise, and for this reason, fatigues less easily and recuperates more readily. In fact, it would seem that the human body may be considered to be a living battery, the brain being one pole, and the outlying parts of the body the other pole, with the nerves the interconnecting wires; with this essential difference, however, that while the living battery charges up with moderate use or exercise, the electric battery always discharges with use. With excessive use or exercise, however, the living, human, battery, like the electrical, discharges and runs down, with resulting fatigue and exhaustion. This ability of the living body to charge and energize itself electrically during activity may constitute the essential difference between living and dead matter.

We have shown that when one non-polarizable electrode was placed directly on the exposed brain cortex of the dog and another on an outlying part of the body such as the scalp, a current flowed from the outlying part to the brain, thus showing that the brain cortex is electro-negative, the scalp electro-positive, and the intervening skull a dielectric.[8] We have determined the dielectric constant of the fresh skull of the dog as well as of the human, and found it to be $2\pm$, hence, the skull is approximately twice as good an insulator as air, and about one-half as good as glass, so that the cranium would seem to qualify as a dielectric between the surface of the brain as one plate, and the scalp, the other plate, to form a condenser. Similarly, in the human the direction of the flow of current is such as to indicate that the brain cortex, like that of the dog, is electro-negative, the scalp, electro-positive, and the intervening skull a dielectric. Hence, the increase in the strength of the current between the head and arm or leg, as occurs with moderate exercise, indicates that the brain cortex has become more electro-negative with exercise; a decrease in the strength of the current, as occurs in fatigue, indicates that the cortex has become less electro-negative, and a reversal in the direction of the current, in states of exhaustion, indicates that the brain cortex has become electro-positive.

The increase in the negative potential of the brain, which occurs with moderate exercise, is attributed to an excess of negative charges or nerve impulses coming to the brain from the skin and outlying sense organs of the body over the negative charges leaving the brain, and going to the muscles over motor nerves, resulting in a gain of negative charges by the brain cortex, thus rendering it more electro-negative. The decrease in the negative potential of the brain in fatigue is attributed to an excess of negative charges leaving the brain by way of motor nerves and going to the muscles, over the negative charges coming to the brain from the skin and peripheral sense organs by way of sensory nerves, resulting in a loss of negative charges, thereby decreasing the negative potential of the brain cortex. In states of exhaustion, the loss of negative charges has become sufficiently great as to render the brain cortex electro-positive, with resulting reversal in polarity, and hence, a reversal in the direction of the current.

EFFECT OF EXERCISE ON THE THRESHOLD OF THE KNEE JERK

The knee jerk was produced in the usual way, namely, by striking the patellar ligament a slight blow with a hammer swung through an arc like a pendulum, as shown in the insert in Fig. 2. The strength of the blow, and hence of the stimulus, was varied by adding or removing weights, ten grams at a time, on a carrier attached to the hammer, while the arc through which the hammer swung was kept constant. The threshold or minimal stimulus was ascertained by determining the weakest blow that would elicit a minimal knee jerk.

The curves in Fig. 2 show the effect of exercise (wrestling) and subsequent rest on the threshold of the knee jerk. Two wrestlers (EK and MG) were chosen of approximately the same size and age, and of equal threshold stimuli. Prior to wrestling it was necessary to add a ten-gram weight to the hammer to elicit a minimal knee kick of each wrestler. After taking exercise, which consisted of wrestling for ten minutes, it was necessary to increase the strength of the stimulus by adding 390 grams to the hammer to elicit a minimal kick for wrestler EK, and 360 grams for wrestler MG, as shown in the curves in Fig. 2. It may be seen further in the chart that it required 8½ minutes, during the period of rest following the wrestling, for the threshold of wrestler EK to return to its initial resting level, and 6½ minutes for wrestler MG.

Several other kinds of exercise were tried, such as running, basketball, football, floor dips, etc., and all were found, like the wrestling, to produce a rise in the threshold of the knee jerk, which was followed by a fall during the subsequent period of rest.

The variation in the threshold of the knee jerk during an ordinary day's work was also determined. Upon arising at 7 A.M., the length of stroke of the hammer was adjusted so that it required the addition of

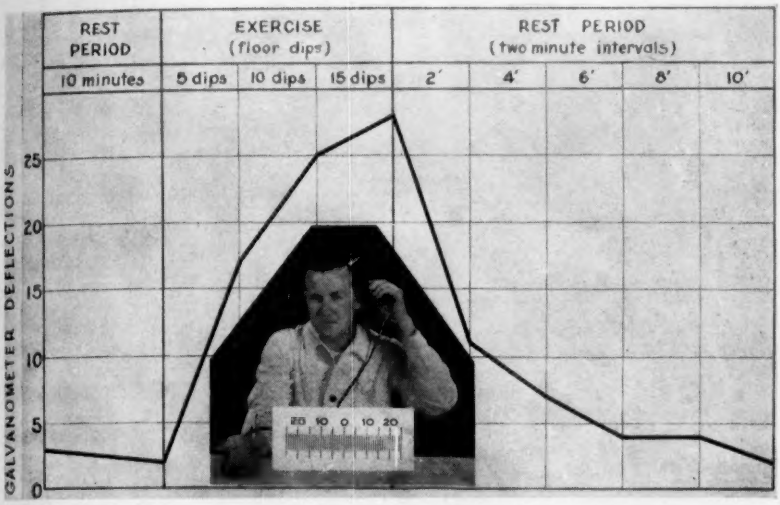


Fig. 1. Insert shows subject with one non-polarizable electrode on head and one on arm, wire connections with galvanometer, beam of light on galvanometer scale. Each scale division represents 0.025 micro-amperes of current. Curve shows current in subject was increased by exercise and decreased during rest.

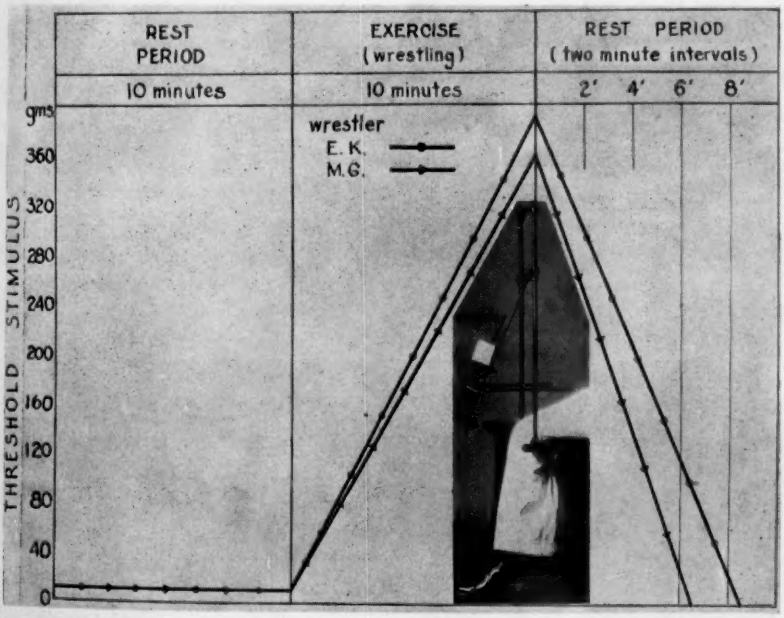


Fig. 2. Insert shows hammer with attached weight carrier for striking patellar ligament to produce knee kick. The strength of stimulus was varied by adding or removing weights. The two curves show that threshold stimulus for two wrestlers, EK and MG, was increased by exercise and decreased during subsequent rest.

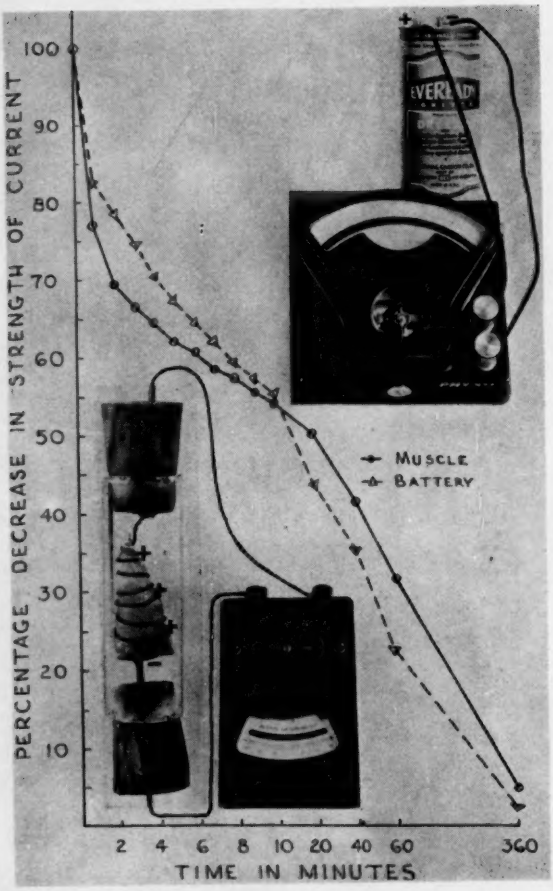
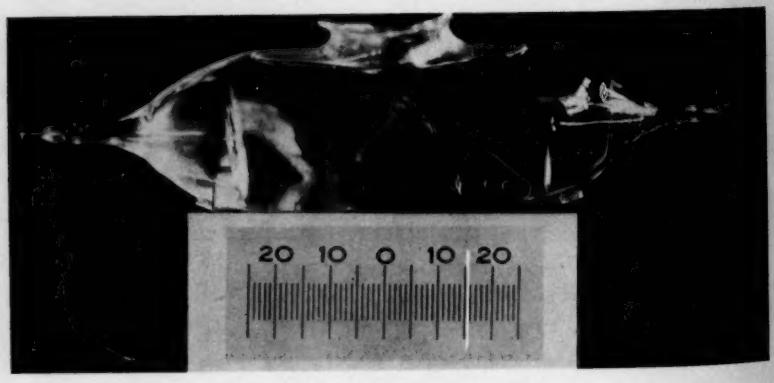


Fig. 3 (left). Upper insert shows ordinary dry cell short-circuited through ammeter. Lower insert shows a muscle with electro-negative, injured end on a platinum plate, and a platinum wire wound several turns around the electro-positive, sound surface, short-circuited through a galvanometer.

The curves show that short-circuiting produced a parallel decrease in the current of the battery and injured muscle.

Fig. 4 (below). Shows goldfish in glass cylinder of water between two platinum disc electrodes, wire connections with galvanometer, and beam of light on galvanometer scale. Each scale division represents 0.025 micro-amperes of current.



10 grams to the hammer to elicit a minimal knee kick of the subject (RK) who was an instructor in the University, age 30. At 10 P.M., the time of retiring after a day's work of laboratory teaching, it required the addition of 595 grams to the hammer to elicit a minimal knee jerk. At 7 A.M. the following morning, upon arising, it required, as on the preceding morning, the addition of 10 grams to the hammer to elicit a kick.

Similarly, the diurnal variation in the threshold of the knee jerk of a carpenter, farm hand, blacksmith, and night watchman was also determined, and it was found to rise during the day's activity, and fall during the night's rest. The greatest fall occurred soon after going to sleep, during the period when sleep was deepest. The threshold of the night watchman rose during the night, the period of his activity, and fell during the day when he was resting. A rise during the day and fall during the night of the negative potential of the brain, corresponding with the rise and fall of the threshold of the knee jerk, was also observed.

COMPARISON OF EFFECT OF EXERCISE ON BRAIN POTENTIAL AND THRESHOLD OF KNEE JERK

From the preceding it will be seen that exercise increased both the negative potential of the brain cortex and the threshold of the knee jerk, and that during the subsequent period of rest the potential and threshold decreased to the initial resting level.

The knee jerk is usually considered to be a reflex act. The blow on the patellar ligament sets up nerve impulses which pass over a sensory nerve to the cord and reflexly over a motor nerve to the muscle stimulating it and producing the kick. Any decrease in irritability at the point of stimulation would necessitate a corresponding increase in the strength of the stimulus to elicit the knee kick. Hence, the increase in the strength of the stimulus made necessary, as observed in this investigation, to elicit a knee jerk, indicates a corresponding decrease in irritability during exercise.

It is known that irritability is decreased at the positive pole, anode (anelectrotonus) and increased at the negative pole, cathode (catelectrotonus). If the increase in the negative potential of the brain cortex during exercise is due, as postulated in the first part of this paper, to an excess of negative charges or nerve impulses coming from the outlying parts of the body such as the knee, then the loss of these negative charges should increase the positive potential of the outlying parts with resulting anelectrotonus and decrease in irritability such as our experiments show to occur.

During exercise an excess of negative charges leaves the peripheral parts of the body, such as the knee, and pass by way of sensory nerves to the brain cortex. Hence, the motor cortex gains negative charges

during exercise at the expense of the outlying parts of the body, such as the knee, which give up these negative charges to the brain, and this loss of negative changes increases the positive potential of the outlying part with resulting decrease in irritability (anelectrotonus) as is indicated by the rise in the threshold of the knee jerk during exercise.

SHORT-CIRCUITING A LIVING MUSCLE

It is known that the injured portion of a muscle is electro-negative, and the uninjured portion, electro-positive, and if the electro-negative, injured area of the muscle be connected by a conductor with the electro-positive, sound surface, a current, the demarcation current or current of injury, will flow from the sound surface to the injured area, or electrons will pass from the injured area to the sound surface, as is the case when the positive and negative poles of a battery are connected by a conductor. The object of the following experiments was to determine if the injured muscle, like a battery, would run down when shorted. For this purpose the gastrocnemius muscle of a medium-sized frog was removed and cut transversely near one end. The electro-negative, cut, or injured end of the muscle was placed against a platinum disc, while a platinum wire was wound several turns around the electro-positive, uninjured surface of the muscle to make extensive contact, as shown in the lower insert in Fig. 3. The preparation was then placed in a closed glass cylinder to prevent the muscle from drying.

Immediately upon connecting the muscle preparation with the galvanometer, or short-circuiting it, a current of 6.5 micro-amperes flowed from the uninjured surface through the galvanometer to the injured end of the muscle. After one minute, the current had decreased to 5 micro-amperes; after two minutes, to 4.5 micro-amperes; after three minutes, to 4.3 micro-amperes; after four minutes to 4.2 micro-amperes, and so on until after the muscle had been short-circuited through the galvanometer for six hours, the current had decreased to 0.3 micro-amperes.

Similarly, when a 1.5 volt dry cell was short-circuited through an ammeter, as shown in the upper insert in Fig. 3, 15 amperes of current flowed immediately. After one minute, the current had decreased to 12.4 amperes; after two minutes, to 11.8 amperes; after three minutes, to 11.2 amperes; after four minutes, to 10.6 amperes, and so on until after the battery had been short-circuited through the ammeter for six hours, the current had decreased to 0.5 amperes.

Hence, an injured muscle is in reality a battery, with the injured portion the negative pole, and the uninjured, the positive pole, and when these two poles are connected by a conductor, a current passes from the positive, sound surface to the injured, negative portion of the muscle, or electrons pass in the reverse direction from the injured to the uninjured part, until the muscle runs down, so to speak, like a battery when it is shorted.

The curves in Fig. 3 show a comparison of the percentage decrease in the strength of the current of the muscle and of the battery, when short-circuited. It will be seen that the curves show a parallel decrease in the strength of the current in the muscle and in the battery.

It was found that the discharged muscle could be recharged, like a discharged battery, by applying a small amount of a weak solution of phosphoric acid or sodium phosphate to the injured portion of the muscle, thereby restoring its negative potential. It is known that phosphocreatin and adenyl-pyrophosphate are hydrolyzed in the contracting muscle, thus supplying the energy for the contraction and giving rise to negative phosphate ions. Injury, like activity, produced an hydrolysis of the phosphate compounds in the muscle, and we have presented evidence to show that the electro-negativity of injured and active muscle is, in part at least, due to these negative phosphate ions.[4] It would be interesting to know what role, if any, the negative phosphate ions play in connection with the negative potential of the brain cortex.

ELECTRICAL POLARITY IN THE GOLDFISH AND THE EFFECT OF REST AND MOVEMENT

A goldfish approximately 6 cm. long was placed in oxygenated water in a cylindrical glass vessel 20 cm. long and 5 cm. in diameter, as shown in Fig. 4. At each end of the chamber there was a platinum disc electrode to which was attached, by means of wires, a moderately delicate galvanometer. As the fish swam around in the chamber, turning its head first towards one electrode and then the other, the beam of light of the galvanometer swung first in one direction across the scale and then in the reverse direction, corresponding with the movements of the fish. It was also observed that when the fish was crosswise in the chamber between the electrodes, the beam of light swung to the zero position on the scale, thus showing that no current was flowing when the fish was in this crosswise position. But when the fish turned towards one or the other of the electrodes, a current of 0.5 micro-amperes or less, depending on the position of the fish, was set up and flowed through the galvanometer as was indicated by the movement of the beam of light on the scale. In fact, even when the fish was concealed from view, its position could be told and its movements followed by observing the oscillations of the beam of light of the galvanometer.

When the fish remained quiet for any length of time, the strength of the current decreased, like that of the human when resting, and, upon the fish becoming active again, the current increased, like that of the human when exercising. The preceding observation has been repeated and confirmed with the use of a great number of goldfish.

The fact that the fish caused a flow of current through the galvanometer similar to a battery and a reversal of position of the fish caused a reversal in the direction of the current similar to reversing the connec-

tions of the galvanometer with the poles of a battery, is taken to mean that the fish, like the human, exhibits polarity, with its head region one pole and tail region the other pole.

The cortex or surface of the brain of the fish, like that of the human, is electro-negative, the skin over the skull being electro-positive, with the intervening skull a dielectric. Michael Faraday was the first to show that the head of the fish (Gymnotus) is electro-positive.[5]

SUMMARY AND CONCLUSIONS

1. Exercise of various kinds, such as wrestling, football, basketball, floor dips, etc., was found to produce an increase in the negative potential of the motor cortex of the brain and a rise in the threshold of the knee jerk, which was followed by a decrease to the initial resting level during the subsequent period of rest. Excessive exercise, however, decreased the negative potential of the brain, and very severe exercise and exhaustion not only decreased the negative potential, but produced a reversal in polarity, thus indicating that the motor cortex had become electro-positive.

2. It is known that negative charges or nerve impulses pass to the brain over sensory nerves from the skin, and outlying sense organs, and from the brain over motor or efferent nerves to peripheral structures, such as the muscles. The electrical potential of the brain cortex at any instant is considered to be determined by the balance between these incoming and outgoing negative charges. If the incoming charges are in excess the brain gains negative charges and as a result, becomes more electro-negative. If, on the contrary, the outgoing charges are in excess, the brain loses negative charges, and as a result, becomes less electro-negative and may even become electro-positive in exhaustion.

3. The increase in the negative potential of the motor cortex of the brain during exercise, as found in this investigation, is attributed to an excess of incoming negative charges over outgoing, resulting in a gain of negative charges by the brain cortex, and hence in a rise of its negative potential. That is, the motor cortex charges up electrically during exercise, and in this way makes possible the discharge of nerve impulses that must take place to stimulate the muscles to contract during exercise. The living, human battery differs from the electric battery in that it charges up with moderate exercise or use, due to the excess of incoming negative charges by way of sensory nerves from the skin and outlying sense organs, over outgoing charges by way of efferent nerves to the muscles and outlying structures, whereas the electric battery discharges with any use, and is recharged only when energy is supplied from without in the form of an electric current.

4. The living, human battery, however, like the electric, does discharge with excessive exercise or use when the outgoing negative charges are in excess of incoming, and as a result of this loss of nega-

tive charges, the motor cortex becomes less electro-negative with a decrease in irritability (anelectrotonus) and resulting fatigue. In very excessive and strenuous exercise the outgoing nerve impulses or negative charges to the muscles are sufficiently in excess of the negative charges coming in from the skin and outlying sense organs as to render the motor cortex electro-positive with a loss in irritability, and resulting exhaustion.

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The Effect of Maturation on Physical Skill as Measured by the Johnson Physical Skill Test

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THIS study is concerned with physical skill in relation to chronological maturation. Its findings give evidence that there is much closer relationship between physical skill and chronological maturation than between physical skill and mental age, school grade, or intelligence.

Thus far no attempt has been made, to the writer's knowledge, to study physical skill in gymnasium activities in relation to maturation.

STATEMENT OF THE PROBLEM

It is the purpose of this study to answer the following questions:

1. Using the Johnson Physical Skill Test [1] as a measure, is there an increase in the skill score with an increase in
   a) Chronological age, disregarding mental age?
   b) Mental age, disregarding chronological age?
   c) School grade, disregarding both C.A. and M.A.?
   d) I.Q.?[2]
2. Keeping the C.A. constant, is there an increase in skill score with an increase in M.A.?
3. What age may be considered the age of maturation regarding physical skill, as measured by the Johnson Physical Skill Test?
4. Is it reasonable to suppose that an average score, or Physical Quotient, can be computed for physical skill based on the Johnson Physical Skill Test analogous to I.Q. for mental ability? [3]

DELIMITATION AND METHODOLOGY

The study is limited to 874 cases. The group was made up of boys in the Denver Public Schools grades five through twelve, and of freshmen in the University of Denver.

To investigate the problem it was necessary to establish a physical skill score, the C.A., the M.A., the school grade, and the I.Q. for each subject.

The only test of physical skill used was the Johnson Physical Skill

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This paper is an abstract of a Master's Thesis, presented at the University of Denver.

1 G. B. Johnson, "Physical Skill Test for Sectioning Classes into Homogeneous Units," RESEARCH QUARTERLY III, (March, 1932), 128–136.

2 C.A.—chronological age; M.A.—Mental age; I.Q.—intelligence quotient.

3 Lewis M. Terman, *The Measurement of Intelligence.*

Test as published in the RESEARCH QUARTERLY of March 1932.

To establish M.A., the Otis Group Intelligence Test (1) was used in all but one school.[4] In this school Terman's Group Intelligence Test was used.[5]

The interpretations and conclusions presented were obtained by examination and comparison of the arithmetic means of the distributions made according to C.A., M.A., school grade, M.A. holding C.A. constant, and a general distribution including all available scores.

RELATION BETWEEN PHYSICAL SKILL AND C.A.

It was found that physical skill as measured improves with chronological maturity from age nine to age sixteen with the exception of the fourteenth year. From age sixteen through age twenty the score is nearly constant, after which time, at the age of twenty-one, the score decreases at about the same rate as increase took place before age sixteen. The average rate of increase and of decrease is 2.5 points on the Johnson scale of scoring. At age fourteen, instead of such an increase there is a slight decrease in score, but at age fifteen there is a jump of five points, making an average increase for the two years of 2.5 points. This suggests that during the period of greatest growth during adolescence there is some disturbance in the physiological make-up of the individual that causes a loss in acquired skill, or a delay in further development.[6] In the next year, however, this delay is made up as though physical skill growth had continued but had not been measurable.

Physical skill as measured does vary with C.A. at a definite rate during definite age periods.

RELATION BETWEEN PHYSICAL SKILL AND M.A.

Relationship between physical skill growth and mental maturity showed increase in skill score with age, but at a different rate of increase. Using M.A. as the scale of maturity, physical skill growth takes place in something close to three-year cycles. The mean score remains rather constant for two or three years and then makes a more noticeable jump than the 2.5 points for each year on the C.A. scale. These jumps are at four points, at ages 8, 11, 13, and 17. There is no real decrease after the maximum score is reached. This suggests that mental growth proceeds at a different rate than does physical skill growth and leads toward conviction that physical skill growth is more nearly relative to chronological maturity than to mental maturity.

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[4] Arthur S. Otis, *Statistical Method and Educational Measurement.*
[5] Terman, *op. cit.*
[6] D. A. Thom, *Normal Youth and Its Everyday Problems,* Chap. 2.

RELATION BETWEEN PHYSICAL SKILL AND SCHOOL GRADE

Grade groupings also show an increase of physical skill with grade. Grouping according to grade, however, tends to group according to age. Skill would then necessarily increase with grade if skill develops relative to C.A. As a result of the overlapping of ages from grade to grade because of retardations, the arithmetic means for grade groupings were not so varied as the arithmetic means for C.A. groupings. Nor did the characteristic decrease during the growth period of adolescence show itself. While there is evidence of physical skill growth in relation to school grade, the above factors give basis to the conclusion that physical skill growth is more relative to chronological maturity than to school grade.

RELATION BETWEEN PHYSICAL SKILL AND I.Q.

Previous studies have shown no correlation between physical skill as measured by the Johnson Physical Skill Test and intelligence.[7,8] This study shows no increase in physical skill because of greater mental ability (I.Q.) except in considering I.Q's. of 70 in comparison with normal or above normal I.Q's.

PHYSICAL SKILL IN RELATION TO M.A. HOLDING C.A. CONSTANT

In grouping all twelve-year olds according to varying M.A., it was found that M.A. makes no difference in physical skill. This grouping gave further evidence that physical skill growth takes place relative to chronological maturity. The mean score for twelve C.A. is forty-eight; for sixteen M.A. is fifty-three; for twelve-year olds with sixteen M.A., the mean is still only forty-eight. These brilliant twelve-year olds are handicapped by their lack of chronological maturity in attaining the physical skill level of sixteen M.A. This indicates that physical skill increases with M.A. only if C.A. has increased also. Stated differently, physical skill does not increase with M.A.

AGE OF PHYSICAL SKILL MATURITY

Based on the findings of this study, age sixteen is the age of maturity of physical skill and the maintenance of this efficiency is continued through age twenty. This conclusion compares favorably with the findings of Dr. W. R. Miles[9] and G. Stanley Hall.[10] Dr. Miles states that man reaches his peak of greatest physical efficiency at age twenty-two and that there is a near attainment of this peak at eighteen. G. Stanley Hall gives age twenty-three as the age of greatest physical strength in man.

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[7] Johnson, *op. cit.*
[8] J. Ewing Beatty, Some Studies in Physical Education.
[9] Dr. W. R. Miles, Correlation of Reaction and Coordination Speed in Adults.
[10] G. Stanley Hall, *Adolescence*, V. I, p. 138.

COMPUTATION OF A P.Q.

The idea suggested itself that it might be possible to establish a P.Q. (physical quotient) analogous to the accepted I.Q. by using the score obtained on the Johnson Physical Skill Test. However, the general mean computed from all available scores does not stand as a representative mean for all age groups in the same manner that 100 does for normal I.Q. regardless of age. It was necessary, therefore, to find a factor that would modify the raw skill score to produce a constant mean for all age groups.

This study indicates that C.A. is the contributing factor in physical skill growth. The precedent set by M.A. in the computation of I.Q. led to the hypothesis that, skill increasing with age, dividing each score by age should reduce all scores to a common factor. Dividing skill score by C.A. in months and computing means for each age group proved that age increased at a greater rate than skill, for there was a fairly steady decrease in mean for each year, even through the years between sixteen and twenty.

Another hypothesis was formed on the basis that C.A. in years could be added to balance the above proportional decrease. This gave the formula

$$\frac{\text{Skill Score}}{\text{C.A. (in mo.)}} + \text{C.A. (in yrs.)}$$

which was tried with satisfactory results.

All combinations of skill score, C.A. in months, and C.A. in years were used to try to find the best possible formula for computing P.Q. using these three factors. Of all these formulae, the above most nearly answered the problem.

There was another possibility for computing P.Q.* which was not experimented with because of the need for a greater number of cases. This possibility is the same as the method used by Terman in computing I.Q., e.g., of comparing the score of the subject with the scale of means for skill score classified according to C. A., to establish the skill level of the individual under consideration. This would give the age level of the subject's skill (the skill age). Divide this skill age by his actual C.A. and the result would be the P.Q. of the subject.

CONCLUSIONS

1. Physical skill, as measured by the Johnson Physical Skill Test, increases with C.A. and with school grade but not with M.A. or I.Q. It is believed that the relation between physical skill and school grade exists because of an increase in C.A. with promotion in school. Therefore, of the four factors, physical skill growth is most nearly related to chronological maturity.

* Suggested by Dr. L. W. Miller, Department of Psychology, University of Denver.

2. Physical skill as measured matures (or reaches its peak) at age 16 and maintains its efficiency through age 20 after which time decrease in physical skill makes itself evident.

3. The results of the work done on developing a formula for computing P.Q. were very encouraging. They suggest a definite possibility of developing such a standard. Of the formulae experimented with,

$$\frac{\text{Skill Score}}{\text{C.A. (in mo.)}} + \text{C.A. (in yrs.)}$$

is favored for computing P.Q. It is assumed that computing a P.Q. in the same way that an I.Q. is computed would be even more satisfactory.

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Participation in Non-Required Activities by Physical Education Major Students

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THE purpose of this article is to set forth, first, the extent to which major students in the department of physical and health education participated in unassigned activities, and, second, to note the range of the activities. These activities were exclusive of their regular practice teaching or other specially required assignments.

Group I consisted of thirty junior students, and Group II of thirty-two senior students. Both groups were composed of men and women students.

I presented the purpose of this survey to the two groups. After the matter was discussed, the students enthusiastically agreed to check up on their own activities for the current year.

I might say that an unimplied recognition for service rendered outside of and in addition to their required courses gave added zest to the undertaking.

Below are listed the various items and the number of participants. The names of the activities and their subdivisions are arranged briefly and alphabetically as expressed by the students themselves.

While there is an apparent repetition, this is due to the fact that the students were asked to be specific. For the purpose in hand, the word "coaching" was considered too general. One student coaches swimming, another football, a third dramatics. Here we have the manifestation of a specific ability in coaching.

Activity	Group I	Group II	Activity	Group I	Group II
Athletics (General)			Playing	7	7
Coaching		1	Refereeing	15	15
Referee		1	Organizing	1	1
Adult recreation	1	3	Baseball		
Arts and crafts work	2	4	Coaching		2
Athletic teams T.U.	2	2	Playing	3	3
A.A.U. meets	3	1	Refereeing	2	2
Basketball			Organizing	2	1
Coaching	6	8	Bird Club	1	

Activity	Group I	Group II
Biology assistant		1
Boating		3
Boxing		
Coaching		1
Meets		1
Boys or girls club		
General	7	4
Boy Scouts		
Leader	4	2
Activities	3	1
Organized	1	1
Camp counselor	17	18
Church activities	7	4
Class officer	4	1
Clubs		
Social	4	
Athletic	1	4
Community recreation	3	3
Crime Prevention Bureau		2
Dancing		
Teaching	1	7
Club	2	8
Recitals	2	8
Dramatics		
Plays	3	4
Musical Comedy	1	6
Minstrel	2	2
Coached Plays	1	1
Writing of Plays	1	
Pageants	2	5
Editorial work		
Templar		2
Club Year Book		1
Evening school recreation	1	
Exhibitions		
T.U. Team	2	6
All Others	2	5
First aid		
Teaching of	2	
Fistball tournament	1	
Football		
Coaching	3	4
Playing		4
Refereeing	9	7
Scouting		1
Organizing		1
Fire Co. member	1	
Friends School		2
Girl Reserves		1
Girl Scouts	2	1
Gymnastics		
Coaching		2
Member Varsity	1	2
Teaching	1	5
Judging in Meet	4	4
Intercollegiate League	1	1
Glee Club	2	1
Hiking	1	1
Hockey		
Coaching		2
Playing	2	2
Refereeing	2	1
Hobby activity		
Club Work	1	
Show		1
Honor societies	1	5
Hygiene lecturer		1
Lifesaving Corps		
Senior	5	3
Examiner	2	3
Movie work		
Operator of Machine		3
Taking and showing Pictures		1
May Queen's Court or Pageant		4
Nursery Center work	1	2
N.Y.A. work	3	1
Olympic candidate	2	
Orchestra playing	2	
Physical therapy		1
Piano playing	1	2
Playdays	3	1
Playground work	3	5
Programs		
May days	3	4
School	1	2
Organized	1	3
Participated in	1	6
Phila. Turners	6	2
Recreation center	3	4

Activity	Group I	Group II	Activity	Group I	Group II
Settlement house	6	10	Tennis		
Singing		1	Coaching	1	
Soccer			Teaching	1	
Coaching	1		On Team	2	
Playing	1		In Matches	1	
Refereeing	1		Officiating		1
Organizing	1		In Tournaments	2	
Speeches or talks	2	8	Trainer for athletes		1
Story telling activities		2	Usher at various functions		1
Student commission	1		Volleyball		
Swimming			Coaching	1	
Coaching	3	2	Playing on Team	2	1
On Team		2	Playing in Tournament	3	1
Officiating	1	3	Refereeing	2	1
Pool Guard	9	8	Organizing		
Teaching	5	7	Waitress		1
In Exhibitions		1	W.A.A.		
Track and field			Activities	5	7
Coaching	1	2	Board Member	3	2
On Team		1	Women's League	1	
Officiating			Y.M.C.A. work	2	1
Organizing	1	1	Y.W.C.A. work	1	4

We have also some evidence of the versatility of major students in physical and health education.

Each student in these two groups spent some of his time in some related activity.

The Use of a Belt to Measure Leg Strength Improves the Administration of Physical Fitness Tests

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TESTS to determine the physical fitness of individuals for the purpose of reorganizing the traditional physical education program to meet individual needs are being administered in an increasing number of public school systems, Y.M.C.A.'s, summer camps, colleges, and private schools. The battery of tests used most extensively in redirecting existing programs is the one developed by Rogers[1] based on the pioneer work of Sargent.

In the application of the P.F.I. battery, many workers have reported considerable difficulty in securing reliable results in the leg test under the old method of testing. This has been particularly true of inexperienced testers who have had to learn the technique without the benefit of critical supervision. Also experienced testers have had the feeling that the true power of the leg muscles has not been reflected in the scores of the taller and heavier types.

Since accuracy in the testing of leg strength is of prime importance in affecting the reliability of scores on the entire P.F.I. battery, this criticism needed to be given careful consideration. Moreover recent research by T. K. Cureton of Springfield College has revealed that leg strength is the most valid test of athletic ability in the entire P.F.I. battery. Since the new belt technique gives both a higher score and a more valid test it increases (*a*) the validity of the P.F.I. as a measure of general health; and (*b*) the validity of the Strength Index (S.I.) as a measure of athletic ability.

It is the purpose of this discussion to acquaint teachers and supervisors, research workers of physical education now using the P.F.I. battery, as well as those who are contemplating the introduction of this definite procedure, with an improved method of measuring leg strength. This improved technique involves the construction and use

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[1] For detailed description see F. R. Rogers, *Physical Capacity Tests*, (New York: A. S. Barnes and Company, 1929).

of a belt which may be easily applied and relieves thigh and arm strain on the part of the subject. The use of the belt to be described will answer the several criticisms concerning leg lift tests.

SPECIFIC DIFFICULTIES OF THE PREVIOUS METHOD OF ADMINISTERING LEG LIFT TESTS

Before describing the construction of the belt which has made possible the improved method of testing leg strength, it is well to point out the specific objections to the older technique of measuring this element.[2] Summarized they may be stated as follows:

1. It is difficult to secure proper adjustment of the crossbar to the thighs of individuals varying in height and weight, and varying in length of thigh and length of arm.

2. Clamping the crossbar to the thighs by means of the tester's hands sometimes bruised the subject and militated against a maximum lift. Subjects so affected occasionally avoided subsequent testing.

3. It is practically impossible for most women to administer leg lift tests because of weaker grip strength than men. Consequently, women in physical education have been slow to adopt P.F.I. tests.

4. It is impossible to hold the bar securely enough to obtain the maximum lift in testing the stronger subjects. That is, the large medium, the exceptionally tall lithe, and the heavy types of individuals, and particularly swimmers, were never as accurately tested as were opposite types.

THE CONSTRUCTION OF THE BELT

Because of the many criticisms of the old method of measuring leg strength, one of the writers (Hathaway) decided to experiment with a belt designed to help both the subject and the tester in securing more reliable results. In approaching the problem several points had to be considered. The material for the belt needed to be economical in construction and it had to be flexible in order to be adjusted quickly and eliminate any possibility of discomfort or inconvenience on the part of the subject.

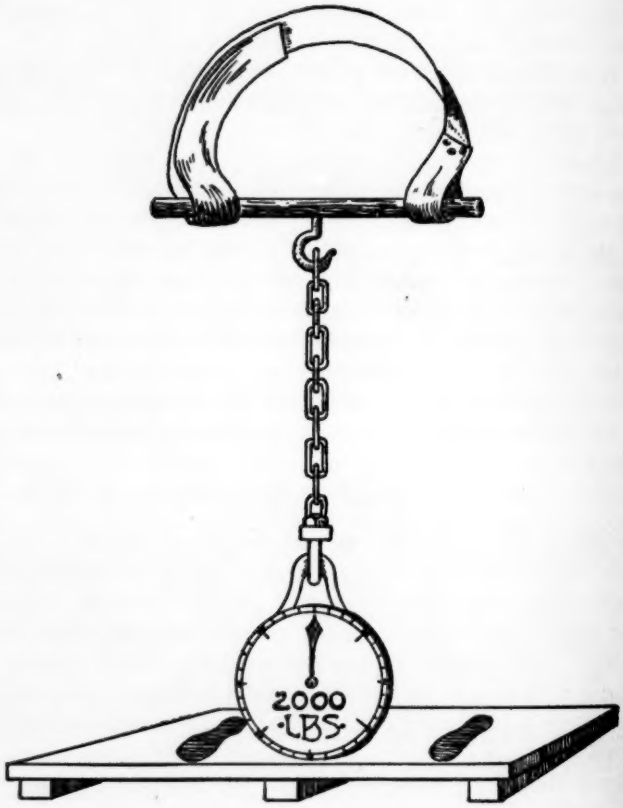
After considerable experimentation the material selected was pliable, heavy, and tightly woven canvas belting, 5 feet 6 inches long and five-sixteenths of an inch thick. The original material used was a piece of axle-light dynamo belting salvaged from a railroad yard. However, fire hose may be used if the canvas belting cannot be obtained. If fire hose is used, the inside tube must be removed retaining only the outside tube for the belt.

The preparation of the belt for use is simple. It requires only one loop to be made at one end of the belt. This loop is slipped over the

[2] F. R. Rogers, *Fundamental Administrative Measures in Physical Education*, (Newton, Massachusetts: Pleiades Company, 1931).

end of the cross bar. In making the loop simply bolt or sew one free end to the body of the belt. The best method is bolting: a strip of metal and washers are placed inside the bolts to prevent the latter from pulling through the belt material.

The following diagram shows the belt attached to one end of the cross bar of the back and leg dynamometer and looped around the other end as it would appear in testing a subject.



LEG TESTING TECHNIQUE USING THE BELT

Those familiar with the old technique of measuring leg strength will note that the use of the belt does not necessitate any radical change in testing technique. The following procedures should be followed when the belt is used in testing leg strength.

1. Have the subject stand erect, placing the feet on the platform so that the mid-points of the arches of the feet are on a line with and perpendicular to the scale on the dynamometer.

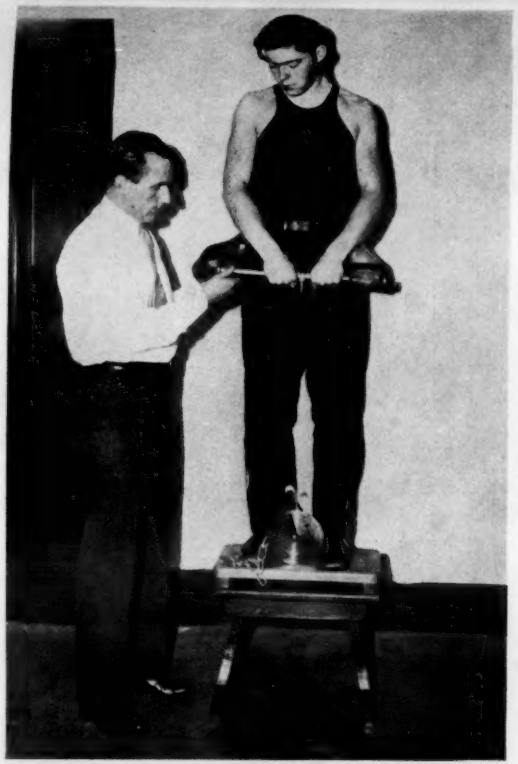


FIGURE 1. The belt has been attached at one end of the crossbar, and the tester is preparing to loop the free end of the belt over the other end of the crossbar.

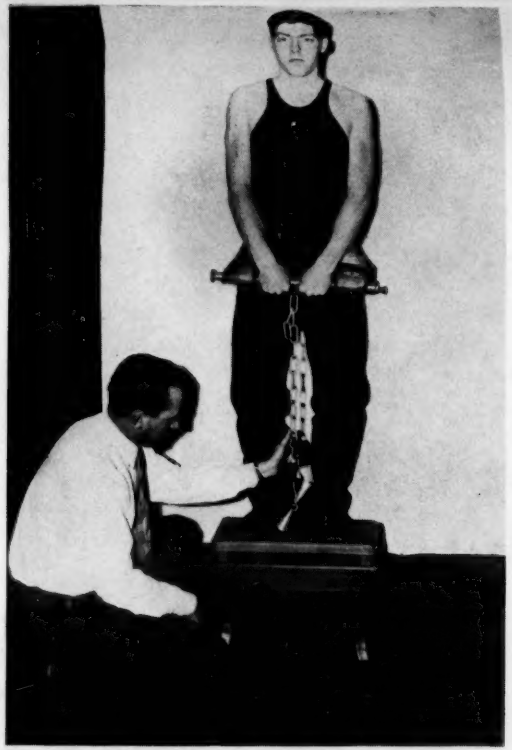


FIGURE 2. The subject has assumed the correct position for the leg lift. Note the position of the arms and the head.

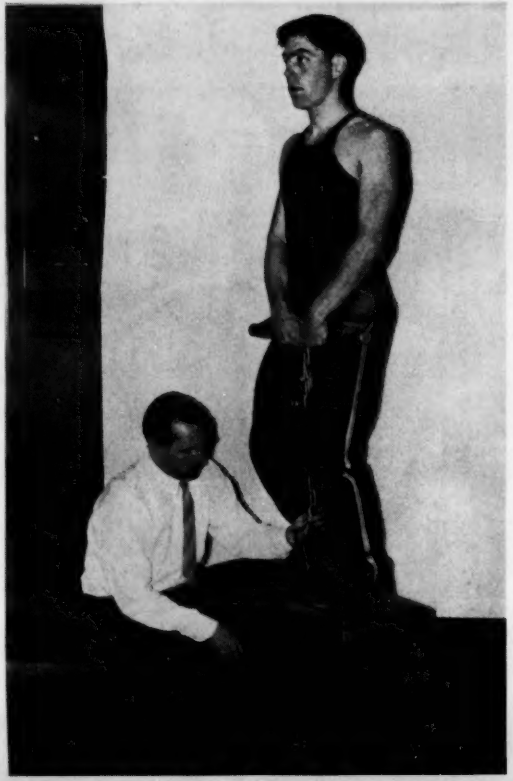


FIGURE 3. A side view of the individual in correct position for the leg lift. Note the angle of the knees.

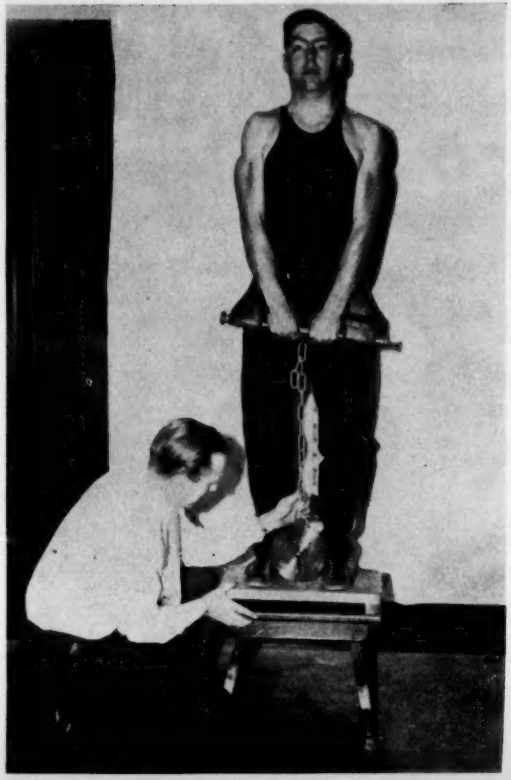


FIGURE 4. The subject lifting. Note the position of the arms and the head.

2. Place the bar in the subject's hands, which are held close together with arms straight down. The bar is pressed lightly against the thighs. Then slip the looped end of the belt over one end of the bar. Bring the free end around the subject's hips just above the gluteal muscles. Then make a loop of the free end of the belt around the other end of the bar, *so that the free end of the belt is next to the body*. The loop must be long enough so the belt will come about two inches below the crest of the ilium. In this position, the pressure of the belt against the body and the resultant friction of the free end against the standing part of the belt holds the bar securely placed so it never slips. Figure 1 illustrates the way in which this preliminary adjustment is made.

3. Instruct the subject to "squat" and then, when his knees are slightly bent (angle of about 130°) place the nearest link of the chain attached to the dynamometer on the crossbar hook. This position is illustrated in Figures 2 and 3.

The choice of the proper link will come from experience. It should be emphasized here that the wrong link—making the chain too long or too short or, rather bending the legs too little or too much—will make a considerable difference (50 to 300 pounds) in the subject's score. *Therefore beginners in testing should give each subject two or three tests with the length of chain changed each time.*

4. Just before the subject is instructed to lift be sure that the arms are straight, the head held erect and the chest up. Figures 2 and 3 show the subject in correct position for the lift.

5. Tell the subject to "push your feet into the floor and *lift!*" Caution the subject to lift steadily, increasing the pull gradually as this will give the best results. Continue to urge the subject to lift! or heave! as long as the pointer shows he is exerting increasing pressure. It usually happens that, in the very first test, many subjects do not know their own strength. They stop before they have given a maximum effort. Verbal encouragement of subjects should be quiet rather than boisterous. Do not urge subjects beyond natural limits. Figure 4 illustrates a subject lifting steadily.

6. When the subject has given the maximum effort, release the free end from the bar and record the reading.

7. While the subject is lifting the tester should watch the pointer rather than the subject. "The pointer tells the story."

FIGURE 4. The subject lifting. Note the position of the arms and the head.

FIGURE 3. A side view of the individual in correct position for the leg lift. Note the angle of the knees.

SUGGESTIONS FOR TESTING VARIOUS TYPES OF INDIVIDUALS

From experience gained in testing large numbers of individuals, it has been found that individuals of varying build present problems in arranging the belt to secure the best results. The following suggestions are given when testing individuals varying widely in build.

1. *The Obese Type.*—Because of his or her girth you may have trouble making a loop big enough to encircle the bar and have the free end long enough to reach its proper place. To solve this problem, make a small loop, place the end of the bar in close to the body and hold the free end of the belt with your two hands. By exerting a little pressure it is possible to get an accurate lift without any slipping.

2. *Very Tall or Long-legged Type.*—Place the bar up on the legs as high as is possible and place the belt around the subject's hips. Bring the loop as far down as possible and hold the free end tightly with both hands. An accurate test may be secured by the tester with no pain or discomfort to the subject.

3. *Very Thin or Small Type.*—Place the loop as near the center as is possible then bring the free end around the subject and make a long loop and place the bar in it. Then you bring the small loop to its proper place and center the bar. The belt *must* fit snugly around the body.

NEW NORMS

The new "belt technique" for testing leg strength greatly increases scores for most subjects. The range of increase is from zero to nearly 100 per cent for subjects whose leg muscle training is with legs almost straight—as for rope skippers, swimmers, and the like. One subject, whose leg-strength is 1200 pounds with the old method has lifted 2500 pounds with the belt. This illustrates the increase in validity of the new method. It is roughly estimated that validity of the P.F.I. as a measure of gross physical fitness is increased 10-15 per cent, and as a measure of endurance 20-25 per cent, by the use of the belt. The average subject increases his leg lift by about 30 per cent.

Of course, new norms are necessitated by the new belt technique. These have been determined for boys. Norm tables for boys 10-20 years of age and for men 20-30 years of age are now available.[3] Records are now being secured for girls and women and will be available shortly.

ADVANTAGES OF THE NEW BELT TECHNIQUE

Physical educators who have used both the belt and the old method of measuring leg strength are enthusiastic supporters of the new procedure. The new technique of measuring leg strength has been in practical operation for the past two years and a half in the Huntington Avenue Branch of the Boston Y.M.C.A., the Physical Education Department of Boston University and a large number of public schools, particularly in Greater Boston and Westchester County, New York.

[3] Norm charts for boys 10-20 years of age and weights 60-200 pounds may be secured from Boston University, Department of Physical Education and for men from the Huntington Avenue Y.M.C.A., Boston.

During the present year, the new method of testing has also been introduced in the several State Teachers Colleges of Massachusetts.

The specific advantages found by the writers and verified by discussion with other experienced testers are the following:

Accuracy in Measurement Is Increased.—The subject being tested is placed in a more natural upright position for lifting with a considerable increase in the angle made by the legs. This results in securing a truer measure of the actual leg strength of the individual over the old method. This is due to a greater mechanical advantage in lifting.

The effect of the new technique is particularly noticeable in the results obtained in testing the very tall and the heavy type of individual. It has been the general opinion of P.F.I. testers that these types have been discriminated against under the old method and have received P.F.I's lower than their true condition actually merits. Doubtless, the use of the belt greatly increased the validity of P.F.I's as it gives a truer picture of the actual total strength of such subjects.

The Confidence of the Subject Is Increased.—The use of the belt with the feeling of support given increases the confidence of the individual, particularly of the timid type who may fear strains.

Greater Safety in Testing Is Afforded.—Since the possibility of abdominal strain has long been a stock objection to the use of the leg strength test in the P.F.I. battery, an additional comment relative to this bugaboo is pertinent. According to measurements made by Dr. George B. Emerson, using an instrument known as the thoracomanometer which he has invented for measuring pressure on either the thoracic cage or the abdomen when the individual lifts, a startling fact has been disclosed. It has been found that when leg tests were given using both the old and the new technique *the pressure exerted on the abdomen was greater when subjects (boys) coughed or sneezed than it was during the leg lift.* In comparing the amount of abdominal pressure that does exist in leg tests, experiments carried out by Dr. Emerson indicates that the pressure is still less when the belt is used.[4] In this connection physicians who have seen the new technique in actual practice no longer hesitate to send individuals who have weak inguinal rings through this element of the P.F.I. test.

Eliminates Errors in Measurement.—A teacher can test a larger number of pupils when the belt is used without losing his effectiveness. Using the old method, it has not been uncommon to discover occasional gross errors in results due to the fatigue of testers. The use of the

[4] Data relative to these experiments are to be published later.

belt conserves the energy of teachers as well as being more satisfactory to subjects.

Another factor which has militated against accurate results in testing has been irritation of the skin and the bruising of muscles caused by the bar being clamped on the thighs. This factor is entirely eliminated with the new technique.

A Distinct Advantage in Testing Girls.—Because the old method of testing was so fatiguing and many women teachers lacked the strength properly to hold the bar on the thighs, P.F.I. testing of girls has lagged. There has also been an objection to men testing girls due to the necessity of grasping the thighs. The belt is a complete solution of these two problems.

Pupils May Be Tested in Ordinary Street Attire.—Some schools desiring to embark on a testing program still have the serious problem of inadequate dressing room facilities; and gymnasium uniforms are frequently not possessed by the pupils. Disrobing was essential in giving the leg test using the former technique. But accurate results can be obtained without disrobing using the belt technique. Of course pupils should be tested in proper gymnasium attire whenever possible.

CONCLUSIONS

The foregoing discussion has been concerned with the description and advantages of an improved technique in measuring leg strength as a part of a battery of physical fitness tests now in wide use. It is proper in conclusion to point out the rewards which are certain to accrue to the profession through the proper use of physical fitness tests.

School administrators are constantly confronted with the problem of convincing school boards or the public that a really valuable and indispensable service is being given in physical education. The public has been fairly generous in supplying gymnasium and playground and auxiliary space for carrying on this particular branch of the educative process. However, there are definite signs that expenditures of public funds for all types of social service, including education, will be more carefully scrutinized in the near future. This is proper, too, when we remember the mounting public debt and the questions being raised by interested citizens concerning the effectiveness of public education, to say nothing of the activities of taxpayers' organizations and other "pressure" groups. Clearly, physical educators have a duty to perform in furnishing school administrators and citizens—who are always vitally concerned with the health of children—with the unique contribution which we can make both in improving the health of pupils and in proving the values of our program.

The use of the new belt technique has increased the efficiency of

physical fitness testing very materially. The use of P.F.I. tests or other valid, reliable and objective measures of general physical condition are indispensable to physical educators in protecting both the present and future health of pupils. Obviously the more accurately we can determine the health status of pupils to protect their present health through the proper differentiation in programs, and the more accurately we can measure what improvement has taken place, the greater will be respect for our work, and public confidence in and support of it.

A Study of Angles in the Measurement of the Leg Lift

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ALTHOUGH the leg lift is an essential part of Rogers' Physical Fitness Index, its measurement is open to some question. Instructions for taking this test, as given in Rogers' *Physical Capacity Tests,* direct the subject to flex the knees so that the thighs make an angle of from sixty to ninety degrees with the legs. At this point the subject lifts with all possible force against a bar across the top of his thighs. The bar is attached by a strong chain to a dynamometer, which records the lift in pounds. The individual's record in pounds indicates his leg lift. The angle at which the lift is made would obviously be of importance in the amount of lift achieved. Although sixty to ninety degrees is recommended by Rogers in his *Physical Capacity Tests,* there was a possibility that a larger or smaller angle might be better. It was decided to make this study in order to determine the angle at which the greatest lift could be made.

In his *Fundamental Administrative Measures in Physical Education,* Dr. Rogers states, "Certain critics have suggested fastening a belt about the hips of the subject, allowing the strain to be taken thus instead of on the thighs and legs. Such a modification might be superior to the present technique but has never been tried." The inevitable sliding of the bar on the thighs in addition to the possible fatigue of an operator measuring a great number of students in a day made it seem wise to adopt this plan in carrying out the experiment.*

Twenty Southern Illinois State Teachers College students, thirteen women and seven men, participated as subjects in this study. Each subject performed the leg lift six times a day for eighteen days, the six lifts being made with the knees at six different angles. The six angles established for one student were used by him throughout the experiment. In order that no one angle would always come at the first or at the last of the series, thus receiving the maximum or minimum of the day's efforts, the first lift was made at a different angle each day, the others following in regular rotation. Consequently, at the end of the eighteen days each of the six angles had been tried first three times, second three times, and so on.

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*See Everts and Hathaway, "The Use of a Belt to Measure Leg Strength Improves the Administration of Physical Fitness Tests," p. 62 of this issue, Ed.

In the performance of the leg lifts Rogers' directions were followed, with the addition that a leather strap was used to hold the bar in place. It was felt that this procedure made possible distinctly better scores. The records were almost always made at the same time of day for each individual. The weather varied between comfortable and extremely hot but did not appear to affect the lifts. Some variation in scores appeared to be due to rest during the week end, but the effect was positive in some cases, negative in others.

The different links in the chain were used to designate the different angles, the links used varying with each student. Because of individual variation, the exact angle at any link was different for each subject. To determine the angle at each link the length of the leg and of the thigh were first taken. The measurements were made from the trochanter to the point on the outside of the middle of the knee opposite the head of the tibia, and from that point to the outer malleolus. Then at each of the six links the distance between the upper landmark on the thigh, trochanter, and the lower landmark on the leg, malleolus, was recorded. With these three measurements the angle of the thigh and leg at the knee for each of the six links was bionometrically determined.

When all the scores for an individual were recorded, his best score at any angle was designated 100 per cent for him. Every score for each angle was divided by that individual's best score, thus showing what percentage of his best the student achieved at each angle every day. The percentages for each angle were added and averaged.

Taken individually, the records were not outstandingly consistent. Only one student had an average of more than 90 per cent on any one angle. This is explainable in that, particularly in the case where one is pulling at an angle which is most unfavorable, it is difficult to get everything into the lift each time. Furthermore, the best pull is generally the first or second. Since the students studied pulled six times each day, there would be bound to be more or less fluctuation. This would, however, be ironed out by the averages.

The accompanying table giving the angles, the number of cases recorded for each, and the average percentages, shows definite trends. At angles of from 115 degrees to 124 degrees the most consistently high scores were attained. Angles of from 125 degrees to 139 degrees rank an obvious second, while angles of above 139 degrees and of below 115 degrees are definitely inferior. Of the latter, angles of above 139 degrees are to be preferred to those of below 100 degrees. It was practically impossible for the students to lift at angles below 75 degrees. These results directly contradict the suggested 60 to 90 degrees.

From the results of this study it would seem reasonable to conclude that the maximum in leg lift is to be obtained when the lift is done with the thighs and legs making an angle at the knees of from 115 degrees to 124 degrees.

TABLE I

Degree of Angle	No. at this Angle	Average Per Cent	Degree of Angle	No. at this Angle	Average Per Cent
165–169	3	33.49	115–119	13	73.26
160–164	2	50.66	110–114	10	58.23
155–159	5	40.23	105–109	11	52.98
150–154	4	47.26	100–104	9	46.66
145–149	2	50.55	95–99	7	36.81
140–144	4	52.89	90–94	9	34.24
135–139	6	66.29	85–89	8	30.83
130–134	9	66.24	80–84	2	20.50
125–129	4	66.25	75–79	4	26.21
120–124	8	71.01			

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Rogers, F. R., *Physical Capacity Tests*, (New York City: A. S. Barnes and Co., 1931).

A Rating Profile for Student Teachers and Teachers of Physical Education

By Margaret C. Brown

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THE usual method of rating student teachers and teachers of physical education is to evaluate, with some marking system, lists of items of professional significance. These represent what a teacher should be, should do, or should know. The number of items to be rated may run into hundreds. It could hardly be expected that busy teachers in public schools who cooperate with the student teaching program of any institution could do justice with such cumbersome instruments of measurement.

Methods of rating student teaching should be based on certain principles.

1. Objectives of student teaching should be stated in terms of specific goals.

2. The rating of student teaching should really be the measurement of these objectives and goals.

3. The rating scale should be short and limited to objectives which are measurable and subject to improvement.

4. The objectives should be formulated in a conference of all concerned with the student teaching program, so that they may have a clear understanding of the outcomes expected.

5. The use of rating scales by the student for self-appraisal is one of the most important incentives for the improvement of teaching.

COMMUNITY SERVICE

These principles may be applied in the student's first teaching experience, the community house. As early as the sophomore year, each student may be assigned to a community house, recreation center, or playground to assist with the physical education and recreation program. During this period of service students should have an opportunity to discuss various school and community problems under the guidance of a social director in one of the local community houses. The objectives of this experience are:

1. Development of knowledge and understanding of community problems.

2. Acquisition of knowledge and experiences basic to an understanding of educational principles and theories.

3. Development of teaching facility.

4. Leadership of children in play activities.

5. Ability to guide the social development of children.

The social director should evaluate the progress made by the student in these objectives. The student should also appraise his progress on the Community Service Report shown below. The Report may then become part of the personnel record of the student.

RATING PROFILE

Community Service Report

Student Teacher.....Community Center.....

Dates of Attendance from.....to.....
Day Month Year Day Month Year

Number of Absences.....Number of Tardinesses.....

Number of Classes Each Week.....Age and Sex of Group.....

Directions

Social directors are requested to evaluate the outcomes of student teaching in a conference with the student. Place a dot in the space representing the letter grade, opposite the objective to be rated. Draw straight lines connecting the dots to form a profile. Supplementary information may be written in the space below the rating form.

Development in	F	D	Average C		A	B
Understanding of community problems						
Knowledge of activities						
Teaching ability						
Leadership of children						
Social guidance of pupils						
Final rating						

Supplementary Information:

Signed.....
Social Director

STUDENT TEACHING IN CORRECTIVE PHYSICAL EDUCATION

Professional studies in corrective physical education, scheduled in the junior or senior year, should include student teaching. Needless to say, this should be supervised by highly qualified specialists in corrective physical education of the cooperating public school systems. The objectives of this second teaching experience are:

1. Ability to identify individual differences in body mechanics.
2. Growth in knowledge of corrective physical education activities.
3. Development of teaching ability.
4. Ability to solve problems in pupil learning.
5. Ability to secure pupil progress.
6. Knowledge of tests and measurements of body mechanics.

The teacher of corrective physical education of the institution should follow up the work of the students and rate their progress in these objectives. This teacher should hold conferences with the students and help them evaluate their own progress. Teachers in charge of the corrective classes should also rate the student's teaching. Different colored pencils may be used to identify these ratings on the report form as shown on page 76.

OBSERVATION AND DIRECTED TEACHING IN PUBLIC SCHOOLS

By the senior year the weaker candidates for teaching should have been eliminated. The final student teaching experience takes place in public schools. Assignments should be made carefully so that the student is placed where he is wanted and can do his best work.

The schedule should be arranged so that the student teacher may be entirely free from institutional requirements and able to give all efforts to teaching. It is advisable, however, to schedule a weekly student conference at the institution throughout the senior year. Preteaching conferences could deal with orientation to the teaching experience. Conferences during the student teaching session might be considered forums where general problems in teaching and learning are discussed. The conferences following student teaching could be planned for a discussion of reports of projects and learning problems. They might also serve as a means of orientating students to the technique of placement. Individual conferences, of course, follow a teaching assignment.

Observation, participation, and student teaching can well be combined in this final teaching experience. A good manual should be used to guide observation throughout the whole student teaching session. If agreeable to the school authorities, a student may visit the school to which he has been assigned early in the term for observation. Then when the teaching session begins, students should observe for a few

RATING PROFILE

Report of Student Teaching in Corrective Physical Education

Student Teacher.....Clinic.....

Dates of Attendance from.....to.....
Day Month Year Day Month Year

Clock Hours Each Day.....Number of Days Each Week.....

Number of Absences.....Number of Tardinesses.....

Directions

In rating student teaching, place a dot in the space representing the letter grade opposite the objective to be rated. Draw straight lines connecting the dots to form a profile. Supplementary information may be written in the space below the rating form.

Development in	F	D	Average C		B	A
Knowledge of individual differences						
Knowledge of corrective physical education						
Teaching ability						
Understanding of learning problems						
Progress of pupils						
Knowledge of tests and measurements						
Leadership and responsibility						
Final Grade						

Supplementary Information

Signed.....
Teacher of Corrective Physical Education

days in order to get information concerning the teaching situation. As soon as students are ready, however, they should begin teaching. Thereafter, the program might include one hour a day for observation, two hours for assistant teaching and two hours of responsible teaching. As assistant teachers, students should learn marginal jobs associated with

teaching through experiencing them. In responsible teaching, one class may be assigned at the convenience of the cooperating teacher. Whenever possible, the second class should be assigned for the whole student teaching period. The student teacher ought to be responsible for its program and progress. Students should be required to take part in the extracurricular program of the school and initiate some project or investigation. It is to be expected that student teachers will attend teachers' meetings and other school functions.

In student teaching, careful preparation is of utmost importance. The planning of large units of activities is the main consideration, but the preparation of daily lesson plans is necessary for the student's own use. The plan should be more in the nature of a diary, recording the progress of the pupils in the achievement of the unit, a summary of pupil learning, learning problems evident, objectives and procedures to be used for the next step as well as an appraisal of the teaching procedure. The student should be required to keep a file of all lesson plans, as well as forms, records, and printed materials used in the administration of the school system where he is teaching.

Student teaching should be viewed as an experience in which academic backgrounds, educational theory, physical education sciences, and physical education activities are integrated. It might be well to have the director of student teaching act as coordinator of the various departments. It is also a good idea to select instructors who are experienced in educational practice for the department of education of teacher-preparing institutions. Students may then observe educational practice in selected schools and classes in applied educational theory may be held there. After student teaching begins, the director should arrange a conference of teachers from public schools who are assisting with the student teaching program. Members of the faculty of the institution concerned with student teaching should also be present. At this time, the institutional philosophy of student teaching may be shared with the cooperating teachers. It is also a good integration practice to give a complimentary course for these cooperating teachers. It might include philosophy and principles, materials, and methods given by members of the staff of the institution.

In the supervision of student teaching, each student should be visited by the instructors in physical education of the institution. Teachers of academic subjects, especially English, could observe student teaching and evaluate their contribution to the education of teachers. The director of student teaching of the institution should visit each student at least twice and observe two classes. At this time, it is desirable to hold a conference with the cooperating teacher and student and, if possible, the principal. Each should receive a written report of the conclusion.

EVALUATION OF STUDENT TEACHING

The evaluation of student teaching is based on the principle that objectives of student teaching should be established and progress in student teaching measured by rating these. The rating form consists of two parts, the Rating Analysis and the Rating Profile. In the Rating Analysis, the teaching experience is analyzed into nine major objectives, four of which are concerned with the development of personal qualities and five with the development of professional abilities. These major objectives are further analyzed into tangible goals of the teaching experience. This Rating Analysis should be used frequently by all concerned with the teaching program to appraise the student's progress in the goals and objectives.

For the final report, the cooperating teacher in the public school should transfer the student's final grades in the nine major objectives to the Rating Profile. The same profile form can be used by the instructors in physical education and the director of student teaching of the institution for their final ratings. The student's final grade in teaching is the aggregate of the several final ratings. The total is also tabulated on the Rating Profile. A copy of this report should be filed with the placement bureau. It might be included in the student's personnel record and forwarded in support of candidacy for a teaching position. The same Rating Profile may be used to follow up the teacher in service.

RATING ANALYSIS [1]

Objectives of Student Teaching

Student Teacher..... Cooperating Teacher.....

School .....

Grades Taught.....Date.....

Directions

Major and specific objectives of student teaching are stated on this form. There is also provision for rating the personal and professional equipment of the student. As the purpose of this measurement is improvement of teaching, students should rate their own progress frequently. Cooperating teachers are asked to submit a confidential rating to the director of student teaching periodically. Letter grades should be used: A (Excellent), B (Good), C (Average), D (Poor), F (Failure).

Elements of Personality

Total Grade

..... A. The development of desirable personal qualities

.....General appearance

.....Appropriate dress

.....Posture and poise

.....Sincerity and industry

.....Health and vitality

[1] Brown, *Rating Profile*, (Ann Arbor, Michigan: Edward Bros., 1938). Copyright reserved by the author.

Total Grade
..... B. Growth in essential social qualities
.....Cooperation and loyalty
.....Courteous consideration of others
.....Leadership and responsibility
.....Understanding of human nature
.....Range of cultural interests and experiences

Total Grade
..... C. Improvement in use of voice
.....Placement
.....Tonal quality
.....Flexibility
.....Enunciation

Total Grade
..... D. Improvement in use of English
.....Pronunciation
.....Correct grammar
.....Fluency of expression
.....Forcefulness

PROFESSIONAL EQUIPMENT

Total Grade
..... E. Improvement in knowledge and organization of subject matter
.....Ability to demonstrate physical education activities
.....Ability to prepare programs and units of activity
.....Ability to make careful daily preparations
.....Ability to keep records of progress of pupils

Total Grade
..... F. Growth in mastery of teaching and learning processes
.....Ability to state objectives clearly
.....Ability to motivate pupil purposing and planning
.....Ability to use teaching techniques such as question, discussion, visual aids, experiments, drill
.....Ability to recognize individual differences and learning problems
.....Ability to provide information and meanings of activities
.....Ability to guide pupils to evaluate their efforts
.....Ability to construct and use tests of skill and information

Total Grade
..... G. The development of organizing and managerial ability
.....Ability to anticipate and solve disciplinary problems
.....Ability to use scientific methods of group classifications
.....Ability to use and maintain gymnasium and playground equipment
.....Ability to make schedules
.....Ability to protect pupils' health and safety
.....Ability to conduct playdays, field days, and athletic contests

Total Grade
..... H. Pupil growth and achievement
.....Increased skill in physical education activities
.....Growth of interest in activity program
.....Improvement in social and moral attitudes
.....Gain in information and meaning of activities
.....Gain in leadership and independent action

Total Grade

..... I. The growth of professional attitudes and interests

.....Gain in capacity for self-criticism

.....Development of interest in activities of school and community

.....Participation in teachers' meetings and professional associations

.....Development of interest in professional literature

RATING PROFILE [1]

Student Teaching Report

Student Teacher.....Date.....

School .....

Directions

This report is the final evaluation of the student teacher's progress in the teaching experience. In rating, place a dot in the space representing the letter grade opposite the objective to be rated. Draw straight lines connecting the dots to form a profile. Additional information is requested on the reverse side of the sheet.

	Development in	F	D	Average C		B	A
Elements of	Personal qualities						
	Social qualities						
	Quality of speech						
	Use of English						
Professional equipment	Knowledge and organization of subject matter						
	Mastery of teaching and learning processes						
	Organizing and managerial ability						
	Pupil growth and achievement						
	Professional attitudes and interests						
	Final rating						

STUDENT TEACHING REPORT

Dates of Attendance from .....to.....
Day Month Year Day Month Year

Dates of Absences.....
Reasons for Absence .....
Dates of Tardinesses .....
Hours of Observation Daily .....
Hours of Participation.....
Hours of Teaching Daily.....
Name of Project.....Rating of Project .....
Grades Taught in Elementary School .....Number of Weeks.....
Grades Taught in Secondary School.....Number of Weeks.....
Hours of Individual Conference.....
Hours of General Conference.....
Supplementary Statement:

.....
Cooperating Teacher

.....
Director of Student Teaching

A Report on Some Experimentation with a Skill Test

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IN THE fall of 1933 some experimentation was started with a series of athletic skills to determine the relationship of these skills to the Strength Index of the New York State Physical Capacity Test. As most of you know, one of the means of using the Physical Capacity Test has been that of employing P.F.I. as the first rough divisor or screen and then forming subdivisions within these larger groups by means of the Strength Index, or S.I., as it is commonly called.

With a decade of experience in the field, it seemed to me that skill played as great if not greater part in the performance of pupils than did any strength such as is indicated by the Strength Index. This opinion is contrary to the contention of F. R. Rogers who stated that "athletic ability in interschool sports depends more on gross strength than upon its refinement in either skill or finesse." If the first and major classification of pupils were to be on the basis of the P.F.I., it must be noted that such a classification would be on the basis of a strength score compared to a norm. If the second classification or subdivision were on the basis of S.I., it would be determined likewise by means of a strength score. Thus it seemed to me more advantageous to make the subdivision on the basis of skill.

The method of attack on this problem was to set up a battery of events requiring skill and then to compare them with the S.I. to see if any positive relationship existed between skill and strength. If a positive relationship existed the indication would be that either could be used for classification since each measures the same qualities. The obvious answer, with such a positive relationship, would be to use the S.I. since this figure was already available from the test given to establish the P.F.I. If a positive relationship were not found, and if one wished to consider skill as one of the factors in classification of pupils he would have to consider some test of skill in addition to the strength factors already determined.

It is probably sufficient to say here that the correlations between the Strength Index and the Skill Test varied from a low of .48 to a high of .64 for the different grade levels studied. The low correlations indicate that the Skill Test measures other qualities than strength.

A paper presented before the Tests and Measurements Section of the Eastern District Association Convention, April 1938, Atlantic City.

I should like to outline the development of the Skill Test as I have seen it apply in my own school situation as a successful means for the classification of pupils.

First let me outline briefly the events of the test. It consists of six events with a football and six events with a soccer ball, each of which can be scored readily by a zone method to give one numerical figure that represents to an astonishing degree the difference in ability or skill possessed by any boy pupil when compared with his classmates. Descriptions of these tests will be found in the Appendix.

The twelve events finally selected as the measure of skill were chosen from a much larger group of tests and stunts that had been in use in the physical education class programs for some years past. The tests were largely selected and adapted from those compiled by S. C. Staley in several of his books and from the older Motor Ability Tests of the A.P.E.A. as developed by J. H. McCurdy's committee several years ago. The events were as follows:

Soccer Events	Football Events
1. Penalty kick	1. Place kick (for accuracy)
2. Corner kick	2. Drop kick (for accuracy)
3. Goal kick	3. Punt (for distance)
4. Throw-in	4. Place kick (for distance)
5. Heading	5. Forward pass (for accuracy)
6. Dribble	6. Forward pass (for distance)

The tests, as selected, included kicking and throwing with both types of balls, with the addition of one test which included running. Soccer and football events were selected because they coincide with the sports in season at the start of the school year, when these tests would logically be given. All tests were made to simulate game conditions or parts of games except that all were made without any personal opposition.

This test has been used with very successful results in the classification of pupils. Following are some of the statistical checks used to prove the reliability and validity of the Skill Test as a measure of skill.

The reliability of the Skill Test was checked by statistical procedures for which the Spearman-Brown prophecy formula was used. The proof that the Skill Test measured a common factor of skill was demonstrated by establishing the total reliability of the test by this method. The correlations between the soccer skill scores and the football skill scores were determined, and the intercorrelations between these two divisions showed r's of .72 to .83.

The reliability of the Skill Test was checked again by making a comparison of the scores of two groups of pupils tested at one time, and by comparing the scores of these same individuals when tested at another time. The scores of two groups tested in 1934 were compared with scores of the same groups tested in 1935. The correlations proved

that distinctions between individuals persisted over a period of time even though the testers were changed. The correlations for the two groups were .74 and .79 respectively.

In a study of the validity of the Skill Test, the test scores were used during the 1934-35 school year as a means for subdivision within each junior and senior high school gymnasium class. The Physical Capacity Test was not used that year due to administrative changes, and so the Skill Test was used to assure some classification of pupils within the various physical education classes. The division was made by arranging the individuals in a given class by rank according to Skill Test scores. Those in the upper half were labeled Group A, or the A League, while those in the lower half were labeled Group B, or the B League. This plan divided the classes roughly into two groups for class routines such as squad work, instructional groups, or groups for competitive or recreational games.

Any competition within the class was limited to intra-group competition. It was very evident to me that this division resulted in a measure of equal competition within each of the separate leagues. Visiting teachers were able to catch at a glance the difference in the abilities of the two groups when both were engaged in activities at the same time on the gymnasium floor.

Additional proof that the Skill Test was a true means of determining skill came at the conclusion of the indoor period when play-offs were arranged in each physical education class between the first, second, third, and fourth ranking teams in the A League and teams of a corresponding rank in the B League.

These play-offs have been continued for four years with the following results that have never been announced before:

Basketball Play-Offs.—

A League, won 74, scored 1272 points.
B League, won 4, scored 288 points.

Volleyball Play-Offs.—

A League, won 77, scored 1267 points.
B League, won 10, scored 670 points.

As you will note, these figures are quite conclusive and represent over two hundred contests, with participation by over two thousand boys.

Through the entire sequence of observations was a hint, first here and then there, that the Skill Test was actually more than a mere collection of self-testing stunts in soccer and football, and that it actually contained the elements of some common and basic factor that was important to most physical education activities. To establish its validity further as a test of some common factor important to physical education classification, another line of approach was taken in 1935–36.

The Skill Test was given again to the boys in grades seven through twelve. The pupils in each separate physical education class were ranked according to scores made on the test, and the members of the classes were divided into quartile groups labeled Quartile Teams I, II, III, and IV in descending order.

These teams then played round robin schedules in soccer, volleyball, and basketball. In addition they ran against each other in a battery of four gymnasium class relay races of the line type.

The initial premise was that with a perfect classification test these teams would finish as follows, in the round robin schedule: Team I would win from the other three teams, Team II would lose to Team I but win from Teams III and IV. Team III would win from team IV but lose to Teams I and II while Team IV would fail to win from any of the other three. This would give theoretical percentage standings on a games won-and-lost basis as follows:

	Won	Lost	Percentage
Team I	3	0	1.000
Team II	2	1	.667
Team III	1	2	.333
Team IV	0	3	.000

In each of the three team games mentioned, the percentages were found to be very close to those predicted, and the scoring of points in the contests followed very closely the indicated degrees of skill as represented by the quartile group. I will give only the table that summarizes the results gathered from each of the three sports.

	Played	Won	Tied	Lost	Percentage*
Team I	56	51	3	2	.962
Team II	56	30	3	23	.566
Team III	49	15	1	33	.313
Team IV	45	3	1	41	.068

*Ties disregarded

When these Quartile Teams were pitted against each other in relay races, the expected results would place the teams in order of their quartile rankings, or, to express it differently, in order of their Skill Test scores. Again the predicted results were true to a remarkable degree. For example, the Quartile Team I from the various classes ran a total of 32 relay races in which they finished first 21 times, second 7 times, third 4 times and at no time were they last. The other Quartile teams scored in the same ratio with Team II being second the majority of times, and Team III being third the greatest number of times.

An investigation to make some comparisons between subjective opinion and the objective score of the Skill Test was attempted in a brief manner. This was done with two basketball teams and one soccer team, and the conclusion from these studies of subjective opinion

clearly shows that the Skill Test selected the outstanding competitors with the same degree of accuracy that a skilled observer or coach would have after several days or even weeks of intimate study and observation of the same individual. A coach's final cut of a reporting squad would leave boys with an average score of from 43 to 46 points as compared with a Senior High School average of 34 for all boys. In other words those boys selected as high in skill by a coach had already been selected as highest in skill by the Test.

No definite proof was established during the progress of this experiment as to why the Skill Test was able to predict individual or group achievement with such a high degree of accuracy. The hypothesis is here offered that it affords a truer basis for prediction because of its emphasis upon leg movements. Some of the classifying tests in use at the present time, and much of the thinking in the physical education field have been based upon the assumption that achievement was based largely upon a fine "hand-eye" coordination. The suggestion is offered here that this conception has been in error, and that we must go back further and take the "base of operations" in all athletic events. It may well be that this "hand-eye" coordination, heretofore considered as fundamental, cannot be brought into play until it has a substantial and well controlled base on which it is to operate.

The emphasis upon skill does not preclude the inclusion of other objectives for the field of physical education. Skills, however, will always remain a primary objective of the program, and a test which predicts these abilities can be used to great advantage by workers in this field. It can be used to classify pupils for intergroup competition, for squad work, and can be used also to discover individual differences in this basic objective of our program.

APPENDIX: DESCRIPTION OF TESTS

An outdoor space 60 yards by 30 yards equipped with at least one soccer goal and one football goal probably represents the minimum space needed. Minimum equipment would be one football, one soccer ball, and one stopwatch.

SOCCER EVENTS

1. *Penalty Kick.*—Subject was allowed three trials from the penalty kick mark with no goalkeeper. The first year one point was allowed for each goal scored. This proved too easy and the scoring was amended in the later years to give two points for a goal scored "on the fly," and one point for a goal scored "on the roll."

2. *Corner Kick.*—Subject was allowed two trials from the corner kick sector. A ball to score had to land in the goal area. Those landing in that part of the goal area directly in front of the space between the two goal posts scored two points. Balls landing any other place in the goal area scored one point. Balls landing on lines were credited with the better of the two possible scores. The total of both trials was scored.

3. *Goal Kick.*—The ball was placed on the goal line and the subject required

to kick it out into the field of play. A ball landing outside the penalty area scored one point, a ball landing past a line drawn thirty-five yards from the goal line, and parallel to it, scored two points. Balls landing past a line drawn tangent to the center circle and parallel to the goal line at its nearest point scored three points. (This line was fifty yards from the goal line). A ball landing past the halfway line scored four points (this line was sixty yards from the goal line). The total of both trials was scored. Balls landing on the division line of two zones were credited with having gone into the higher scoring zone.

4. *Heading.*—The subject was required to stand on or outside the goal area line that was parallel to the goal line and directly in front of the goal mouth. He then tossed the ball into the air and attempted to score a goal by heading. Three trials were allowed and the total of the three recorded. Balls through the goal on the fly were scored as two points and those through on the roll as one point. Poor tosses need not be headed and the ball may be thrown up again after a defective toss that has not been touched by the subject's head.

5. *Throw-in.*—The subject was required to stand on that part of the goal area line that was at right angles to the goal line, and by using a legal throw-in style, throw for distance. Two trials were allowed and the total of both scored. Balls landing at or beyond the nearer goal post scored one point, those landing at or beyond the further goal post scored two points. Those balls landing on or beyond the line that was a counterpart of the one the subject was standing on scored three points.

6. *Dribble.*—The contestant started at the halfway line and dribbled towards the goal and was required to score a goal at the end of his dribble. The requirement was also made that the subject's foot touch the ball at least six times in the course of this dribble. The attempt was timed with a tenth-second stopwatch with the watch being started at the instant the subject's foot first touched the ball to start the test. The watch was stopped when the goal was scored. Scoring was done according to the accompanying table. Two trials were allowed with the better of the two credited to the subject.

Elapsed Time	Score in Points	Elapsed Time	Score in Points
over 12 sec.	0	9 to 9.9 sec.	3
11 to 11.9 sec.	1	8 to 8.9 sec.	4
10 to 10.9 sec.	2	7 to 7.9 sec.	5

FOOTBALL EVENTS

1. *Place Kick* (for accuracy).—Two tries for a goal from the field were allowed from twenty yards out (the ten-yard line on a football field having the goal posts on the end line). One point was given for each goal scored. Fifteen yards out was used for grades seven and eight.

2. *Place Kick* (for distance).—Two trials were allowed from the end line with the subject kicking out into the playing field. The kicks were scored where they first landed in the scoring zones described under the Goal Kick in the soccer events. The total of both trials was scored. The subject could place his ball in a small depression in the ground or have someone hold it for him. This event is similar to the kick-off commonly used to start a football game.

3. *Forward Pass* (for accuracy).—The subject was allowed three trials from twenty yards out and was required to pass the ball through a soccer goal "on the fly" to score. One point was allowed for each successful attempt. Fifteen yards was used for grades seven and eight. Trials that hit the cross-bar or uprights were counted as successful. It was supposed here that the area of a soccer goal (8 feet by 24 feet) represents the approximate area that a forward pass receiver could cover.

4. *Forward Pass* (for distance).—The subject had two trials and was required to throw the ball out into the field of play from a starting point on the end line. One point was given for each ten-yard line, in advance of the starting mark, that the ball passed in flight. The total of both trials was scored. Balls landing on a division line between zones were credited with having crossed that line.

5. *Drop Kick.*—Two trials for a field goal were allowed from twenty yards out. One point was given for each goal scored. Fifteen yards out was used for grades seven and eight.

6. *Punt.*—Two trials were allowed from the end line with the subject punting out into the field of play. The kicks were scored where they first landed in the scoring zones described under the Goal Kick in the soccer events. The total of both trials was scored.

Evaluating the Effectiveness of Supervision for Student Teachers

By Mabel E. Rugen
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INTRODUCTION

THE fourth yearbook of the Department of Supervisors and Directors of Instruction of the National Education Association is devoted to the "evaluation of supervision." [1] Evaluation of anything is dependent on judgment and appraisal. "By evaluation is meant *appraisal,* or the judgment of the worth of the item as a whole, with reference to some adopted purpose. Such a judgment is built up from independent judgments on the separate characteristics of the item by combining them on the basis of an adopted plan of weighting. The products of evaluation, in contrast with those of measurement, are always colored, i.e., almost completely dependent upon the standards of values adopted." [2]

Several standards by which evaluation of supervision may be judged are suggested.

"1. Effect. The degree to which its effect upon persons—and upon educational methods and materials approximates the results desired.

"2. Activities. The degree to which (supervisory) activities conform to accepted standards for supervisory activities.

"3. Supervisor's characteristics. The degree to which the characteristics of the person who is doing the supervision conform to the standards for such traits." [3]

These standards are similar to those employed in evaluating teaching. This is significant for emphasizing the similarity between teaching and supervision and lends importance to "supervision as the improvement of teaching."

In supervising student teachers it is difficult to separate supervisory from teaching activities, since the main concern of the supervisor is to teach student teachers how to teach! The same procedures applied to the evaluation of teaching, therefore, logically apply to the evaluation of supervision.

A paper presented before the Midwest District Association Convention, April 1938 Chicago.

[1] *Evaluation of Supervision, Fourth Yearbook, Department of Supervisors and Directors of Instruction.* (New York: Bureau of Publications, Teachers College, Columbia University, 1931.)

[2] *Ibid.,* p. 12.

[3] *Ibid.,* p. 15.

PLAN OF SUPERVISION AT THE UNIVERSITY OF MICHIGAN

At the University of Michigan, a definite plan for the evaluation of student teaching is in effect. Briefly stated this includes:

1. Diary reports of all lessons taught. This report is written by the student following the teaching and is aimed to help her evaluate the lesson in terms of the objectives and teaching procedures planned for the day.

2. Brief individual conferences following teaching, between student teacher and critic teacher or supervisor.[4] These brief conferences are designed to help the student teacher recognize good points in her experience, and problems which need attention.

3. Written evaluations by supervisors on specific lessons. These are made out in duplicate. Points for discussion and suggestions for improvement as well as good features of the lesson are included.

4. Group conferences which offer opportunity for the pooling of experiences and the formulation of specific aids.

5. Evaluation conferences about the middle of the semester followed by a "confidential" written report made by the supervisor.

6. Group or individual written reports by student to supervisors at the end of the semester "evaluating" the quality of supervision.

GOALS FOR STUDENT TEACHING

Putting this plan into effect requires the cooperation of student teacher and supervisor. It can be seen readily then that the quality of the supervisory process is reflected in the quality of student teaching. Emphasis is placed on self-evaluation as a basic procedure in improving student teaching. The same may be said for supervision. It is believed that in the last analysis evaluation may be thought of as a "state of mind," a more or less continuous process, a constant part of reflective thinking.

If the criterion of *effect* is accepted as the basic idea for the evaluation of supervision, then it may be assumed that the quality of supervision may be determined at least partially in terms of the extent to which it influences the progress of student teachers toward the achievement of desired educational goals.

Certain goals for student teaching based on the functions of the teacher have been set up. These center around activities associated with:

1. Class organization and control.
2. Successful use of various teaching procedures.
3. Effective planning.
4. Knowledge of subject matter presented.
5. Understanding the needs of pupils.

[4] "Supervisor" should be interpreted to include critic teacher in the discussion from here on.

6. Self-evaluation and improvement in teaching.
7. Selection and attention to equipment, facilities, and physical environment.
8. Routine and clerical duties.

SUPERVISORY PROCEDURES

The job of the supervisor is to effect such organization and supervisory procedures as will enable the student teacher who has successfully completed three years of the professional curriculum in physical education to meet with reasonable success in her teaching.

"Policies and procedures are based on the belief that supervision exists for the primary purpose of improving teaching. The student teacher learns to teach by teaching. When she is so engaged, the critic teacher and supervisor act as cooperating teachers, who participate in the regular class activities and give assistance as needed. . . . Success in teaching is necessary for growth. This is as true of the experienced teacher as of the beginner. One of the jobs of those responsible for directed teaching . . . therefore, is to provide experiences in which the student teacher will be successful. Too much discouragement at the beginning is a bad thing. . . . We try to put this philosophy into practice by employing certain procedures." [5]

Supervisory procedures in effect over a period of years have included:

1. Activities associated with planning.
2. Activities associated with visitation.
3. Activities associated with group and individual conferences.
4. Activities associated with demonstration teaching and directed observation.
5. Activities associated with specially prepared bulletins, work book and Teaching Manual [6] materials.
6. Activities associated with student evaluation of teaching and supervision.

RATING THE EFFECTIVENESS OF SUPERVISION

The question may be raised as to how effective these procedures have been. The same general plan of supervision has been in effect for nearly eight years. Two years ago, graduates of the classes of 1931 to 1935 inclusive were asked to rate the effectiveness of the procedures employed while they were students teachers. The remainder of this paper is devoted to the responses of these graduates.

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[5] Mabel E. Rugen, "Supervising Student Teachers in Physical Education at the University of Michigan." RESEARCH QUARTERLY 7 (Mar. 1936), 44–55.

[6] Mabel E. Rugen and Jeannette Saurborn, *Physical Education Teaching Manual.* (Ann Arbor, Michigan: Edwards Brothers, 1936.)

A five-page rating scale was returned by 44 graduates, 95 per cent of whom were teaching or had taught physical education. Experience in teaching ranged from a few months to five years. It was felt that this group was near enough to its student days and yet had experience enough in actual teaching to have a contribution to make towards the evaluation of supervision for student teachers. Each rating scale was accompanied by a personal letter. These letters were dictated and phrased to recall certain mutually enjoyed college experiences.

The general direction introducing the rating scale was intended to enlist wholehearted cooperation. "We are interested in evaluating certain supervisory procedures used in helping student teachers of physical education learn to teach. You were exposed to most of the procedures which appear below. Please rate them in terms of what you think they contributed toward making you a successful teacher. If you have done no teaching, fill in the parts of the questionnaire that you can. We are anxious to have your comments and suggestions for improving directed teaching and for helping our student teachers to become better. Perhaps looking up your directed teaching notebook might help refresh your memory."

The items included on the rating scale were organized around six major activities suggested earlier: planning; evaluation of teaching; conferences; use of bulletins, problems, work books, and professional logs; amount and type of teaching; and success in teaching. The items included under the first four of these were rated on a five-point scale ranging from "very valuable," "valuable," and "helpful" to "little value" and "no value." Opportunity was given for suggestions regarding the value and for improving the effectiveness of the procedures. Students were asked also to indicate the extent to which they found the procedures helpful in their teaching "on the job," and which of the procedures, e.g., weekly lesson planning, use of workbooks, they used at the time the questionnaire was filled in.

Very few items were rated as having "no value" and these had only a few frequencies. On the other hand, there were a surprisingly large number of items rated as "very valuable," in fact this was the most popular rating when all items were considered.

VALUE OF PLANNING PROCEDURES

Tables showing the distribution of items follow. The first of these tables shows the extent to which forty-four physical education graduates felt planning was valuable as a teaching experience. In interpreting this table, certain comments should be kept in mind, for example, one graduate stated: "After teaching a while I find it unnecessary to use all the procedures for planning" as suggested in rating scale. While the consensus of opinion seemed to be that planning was a very valuable procedure, one might raise the question of why a larger number of graduates did not indicate the kind of planning practiced on the job.

TABLE I

THE VALUE OF PLANNING TO STUDENT TEACHERS ACCORDING TO PHYSICAL EDUCATION GRADUATES AND THE KIND OF PLANNING THEY USED "ON THE JOB"

Kind of Planning	Very Valuable	Valuable	Helpful	Little Value	No Value	No. of Replies	Kinds of Planning Used on the Job	
							At some Time	Now
Large unit for season	17	13	8	1	0	39	24	17
Seasonal calendar	19	13	5	0	0	37	26	17
Weekly lesson plans in some detail	16	15	12	0	0	43	27	26
Planning first period in considerable detail	20	12	7	0	0	39	28	17
Rainy day and cold weather plans	22	13	4	4	0	43	25	17
Weekly plans ready and approved by Monday	18	17	5	1	0	41	11	9
Use of set form for lesson plan	18	9	13	3	0	43	14	11

Table II may partially answer the question of limited planning on the job when it is noted that of the twenty-eight graduates answering the first question, twenty-six felt they had achieved satisfactory skill in planning. Still one may wonder why the other sixteen did not answer this question. However, another factor that might have some bearing on this point is the fact that nearly half of the graduates (twenty) were not requested to submit plans for inspection by some "superior" school officer.

TABLE II

SKILL IN PLANNING AS EXPRESSED BY PHYSICAL EDUCATION GRADUATES

Measure of Skill	Yes	No	No. of Replies
Do you feel you know how to plan efficiently and effectively?	26	2	28
Have you given aid to others in planning?	14	20	34
Have you been expected to present your plans to a "superior" school officer?	15	20	35

VALUE OF EVALUATION PROCEDURES

Various procedures for helping the student teacher evaluate her progress are employed as supervisory procedures. Table III shows the extent to which graduates felt these to be valuable. It is interesting to note that the confidential written evaluations by the supervisors were thought to be the most valuable, and the daily diary reports which the student wrote the least valuable. Perhaps this is because student teachers are anxious to know, quite frankly, the kind of impression they are making.

TABLE III

THE VALUE OF EVALUATION PROCEDURES TO STUDENT TEACHERS ACCORDING TO PHYSICAL EDUCATION GRADUATES

Kind of Evaluation	Very Valuable	Valuable	Helpful	Little Value	No Value	No. of Replies
Daily diary reports (own evaluation)	14	8	11	8	2	43
Written by supervisors on specific lessons	25	9	6	0	0	40
Confidential written progress evaluations at end of 6–8 weeks (by supervisors)	29	7	2	1	1	40

Digression long enough to describe briefly the type of "confidential evaluation" employed might be justifiable. At the time the graduates filling out the rating scale were student teachers, the procedure consisted of a written analysis, supported by concrete illustrations of observed behavior. This type of evaluation arose in response to student request. Its primary purpose was to give the student teacher our impression of the kind of teacher we thought she was, and to establish more understanding relations between the supervisors and student teacher. The items commented upon were:

"1. Professional attitude. This pertains to the directness and sincerity with which the student goes about her teaching responsibilities. This also includes professional interest and enthusiasm observed.

"2. Professional responsibility. This includes quality of preparation and planning; promptness in completing assignments; keeping appointments; and attending to teaching duties.

"3. Teaching ability as demonstrated. This includes general approach, contacts with students, methods used and their effectiveness.

"4. Teaching personality, which includes voice, dress, poise, social behavior, and analysis of own teaching difficulties." [7]

This procedure has been revised somewhat the past two years. The

[7] Rugen, *op. cit.*

written evaluation is preceded now by a lengthy, friendly, individual evaluation conference at which time the student teacher is asked to discuss her own strengths and weaknesses as she sees them. The supervisor plays the part of the "interlocutor" and tries to frame her questions so the student teacher will make the first comment. A series of written questions dealing with evaluation of student teaching are prepared and used as the basis for the conference. These questions are discussed in a general group conference first, suggestions for additions and omissions are requested, and then the student teacher is asked to "think them over" while the supervisors do the same thing. When we meet in conference, therefore, there has been considerable preparation. Questions center around the following points: (1) preparation for teaching, (2) presentation, (3) personal qualifications for teaching, and (4) extent to which effort has been made to measure results of teaching. After the conference, which always takes at least an hour and sometimes nearly two hours, the supervisor prepares a written summary as the "confidential" report. Student teachers seem to prefer this approach to the one used formerly, since it is more personal, friendly, and at the same time just as objective.

VALUE OF CONFERENCES

Various kinds of conferences have been employed in helping student teachers learn to teach. Generally speaking, graduates consider the conferences valuable (Table IV). In asking whether student teachers should be expected to write up an account of their individual conferences, twenty-eight of the graduates said "no," while fourteen thought it a good idea. In response to the question, "Would it be helpful to the student teacher if the supervisor would provide an outline of the points discussed in individual conferences?" twenty-six said "yes" and eleven "no." This response carries a specific suggestion for improving supervision, since supervisors have not been consistent in providing student teachers with this service.

Of the various kinds of conferences listed in Table IV, it is interesting to note that the short informal discussions immediately following teaching are felt to be the most helpful. Making this practice more effective raises some difficult problems of scheduling for student teaching. None of the various kinds of conferences used was thought to be of no value.

VALUE OF BULLETINS, WORKBOOKS, ETC.

The value of bulletins, written problems, workbooks, and professional logs [8] seems to warrant their continuance. Much of the material used in this way at the time the respondents in this study were student teachers has been included in a Teaching Manual [9] which is

[8] Student teaching notebooks containing all lesson plans, discussions, etc.
[9] Rugen and Saurborn, *op. cit.*

TABLE IV

THE VALUE OF CONFERENCES TO STUDENT TEACHERS ACCORDING TO PHYSICAL EDUCATION GRADUATES

Kind of Conference	Very Valuable	Valuable	Helpful	Little Value	No Value	No. of Replies
Informal "conferences" immediately following teaching, two to five minutes long	17	8	3	1	0	29
Scheduled weekly individual conferences	13	8	8	2	0	31
Occasional individual conferences, two to three per semester	11	5	9	4	0	29
Frequent individual conferences at student's request	16	11	7	2	0	36
Scheduled weekly group conference	10	7	10	8	0	35
Combination group and individual conferences as needed	6	3	5	6	0	20

one of the basic references for student teaching. Workbook materials and problems for orienting the student teacher were not employed until the fall of 1931. The number of graduates who have found their "professional logs" helpful in their teaching is interesting, thirty-one answering in the affirmative.

TABLE V

VALUE OF BULLETINS, WRITTEN PROBLEMS, WORKBOOKS AND PROFESSIONAL LOGS TO STUDENT TEACHERS ACCORDING TO PHYSICAL EDUCATION GRADUATES

Kind of Material	Very Valuable	Valuable	Helpful	Little Value	No Value	No. of Replies	Materials Used on the Job: At Some Time	Materials Used on the Job: Now
General bulletins with suggestions for improving teaching	13	16	4	2	0	35	12	7
Assigned problems to orient students into teaching	(Not in use 1930–31)							
	14	10	10	2	0	36	13	10
Assigned problems for planning, teaching procedures, etc.	(Not in use 1930–31)							
	9	12	14	2	0	37		
Use of workbook	(Not in use 1930–31)							
	16	10	5	1	1	33	11	5
		Yes			No			
Should professional logs be required?		36			1		17	14

VALUE OF THE AMOUNT AND TYPE OF TEACHING

An effort was made to evaluate the amount and type of teaching experienced as a student teacher, and also the success felt as a student teacher through a series of "yes" and "no" questions. The results appear in Tables VI and VII. It is apparent from Table VI that the majority of graduates felt more time should be devoted to student teaching. In spite of this lack, by far the majority of graduates felt they developed average skill in the use of certain basic teaching procedures (Table VI).

TABLE VI

OPINION OF PHYSICAL EDUCATION GRADUATES REGARDING THE AMOUNT AND TYPE OF STUDENT TEACHING

Questions	Yes	No	No. of Replies
1. Do you think you had enough opportunities for actual teaching:			
a) On the high school level?	19	22	43
b) On the elementary school level?	26	13	39
2. Do you think you had experience in a wide enough variety of activities?			
a) On the high school level?	15	23	38
b) On the elementary school level?	17	15	32
3. Do you think you had opportunity to contact enough different grades:			
a) On the high school level?	16	27	43
b) On the elementary school level?	17	25	42
4. Do you think your period of participation with high school students when you were being oriented to teaching was helpful?	33	8	41
5. Do you think opportunity for observation in the classroom before teaching in the elementary grades was helpful?	36	7	43
6. Do you think you developed at least average skill in the use of the following teaching procedures:			
a) Discussion?	35	4	42
b) Demonstration?	38	4	42
c) Drill?	38	3	41
d) Coaching?	28	16	44
e) Refereeing?	29	12	41
f) Use of written examination?	24	18	42
g) Use of projects?	14	24	38
h) Organization?	39	4	43
7. Do you think you had enough experience in organizing groups?	20	24	44

Suggestions for increasing the type of opportunities for more student teaching were offered by most of the graduates. Some of these suggestions follow:

1. "Noon supervision with wide age range."
2. "Settlement work."
3. "Actually handling classes first day of semester."
4. "Adult recreation groups."
5. "Allow more time for teaching."
6. "Encourage participation in campus activities which require leadership; also in organizing Camp Fire or Girl Scout groups."
7. "Encourage summer employment."
8. "Opportunities to conduct 'gym' demonstrations."
9. "Opportunities for practice in conducting afterschool sports; intramurals; organization of groups and the amount of student leadership given."
10. "More teaching helps for hygiene; classroom experience."
11. "To help student teachers apply theory to practical experience, I think it would be a good idea to have a course of talks given by girls who have had one or two years of actual experience and who still remember the problems of their student teacher days, telling just *how* they applied their theory to their work and how this application 'turned out.' "
12. "Teach all elementary grades even if only a few times."
13. "More experience with elementary grade boys."
14. "Dancing—to stage operettas."
15. "Observation for teaching academic subjects."
16. "Mixers and miscellaneous parties."
17. "Opportunity for large classes using a minimum of equipment."
18. "Change teaching group at end of season."
19. "More emphasis on bulletin board displays and keeping up year-round interest in physical education."

SUCCESS OF STUDENT TEACHING

The success of graduates as student teachers was felt to be an indication of the effectiveness of supervision, especially when compared to the success felt since obtaining a teaching position. Inspection of Table VII indicates some discrepancy between success felt as a student teacher and since graduation. The item which seems to have the greatest bearing on this difference is the comparatively large number of graduates who thought they could have been more successful in their student teaching if "other circumstances" had existed. These circumstances are recognized as handicapping influences and were expressed quite frankly as follows:

1. "My self—state of mind—everything."
2. "Lack of confidence in the critic teacher."
3. "Interference in disciplinary problems; either misunderstanding between director and myself or her attitude toward me was wrong."
4. "Situation in high school *too ideal*; too much equipment; classes too small; students too ideal."

5. "Set up too ideal."

6. "Boundaries prescribed by supervisors were too confining."

7. "Any handicapping features present were caused by my own foolishness!"

8. "Not enough time for student teaching."

9. "Not being allowed to experience more for myself."

10. "Having pupils know you were a student teacher."

11. "My own careless planning, perhaps!"

12. "Lack of confidence in my own ability as a personality and a teacher and performer. Insufficient skill."

13. "My own attitude."

14. "Lack of accompanist for rhythms—having boys and girls together for rhythms."

15. "Lack of observation of previous teachers."

16. "Receiving the confidential evaluation too late."

17. "Felt too cramped in the high school. Never felt that the class was mine to teach."

18. "The handicap was within myself in the fact of my immaturity. I could not bring about that certain "distance" that should exist between teacher and pupil. Perhaps I was not prepared for that age group."

19. "Health—nervousness; personality reactions."

20. "Lack of time—too short a period in elementary schools."

These comments can be understood best when the specific situation which the graduate experienced as a student teacher is recalled. When this analysis is made, many faults come to the attention of the supervisor which have been partly corrected since this study was made (1935–36).

TABLE VII

OPINION OF PHYSICAL EDUCATION GRADUATES REGARDING SUCCESS IN STUDENT TEACHING

Questions	Yes	No	No. of Replies
Did you feel you made a success of your student teaching:			
a) in high school?	27	10	37
b) in elementary school?	24	14	38
Do you think you might have been more successful if "other circumstances" had existed:			
a) in high school?	16	13	29
b) in elementary grades?	13	15	28
Do you feel you have been successful in your present position as a teacher?	29	1	30
Do you feel you were successful in former positions?	17	1	18

Additional suggestions for improving student teaching were contributed. Most of these dealt with the way in which supervisory procedures were employed. Suggestions are as follows:

1. "Have student teachers develop workbooks, bulletins, etc., for incoming teachers."
2. "An annual criticism of current professional literature to add to one's professional library."
3. "Conferences frequent enough to give the student teacher a feeling of security."
4. "Let student teacher try out some of her ideas—don't condemn her ideas too quickly."
5. "Evaluation conferences to point out weaknesses and successes *before* end of first season."
6. "Adapt use of various tools to individual teachers. Beware of making student 'conference conscious.' "
7. "More demonstration teaching and more opportunity for observation."
8. "More emphasis on disciplining children."
9. "More individual and less group conferences."
10. "More conferences immediately following teaching."
11. "Make weekly plans in skeleton form and elaborate detail shortly before teaching."
12. "Give student teacher more responsibility in planning program."
13. "Place more emphasis on correction of those faults which the student teacher discovered herself rather than on those supervisor saw."

CONCLUSION

Comments, suggestions, and opinions of former student teachers may not always be unbiased. For this reason the technique presented here may be questioned as a desirable one in evaluating the effectiveness of supervision of student teachers. Nevertheless, each comment, each suggestion, and each response on the rating scale indicates a judgment of one who has experienced a certain kind of supervision. The products of this experience, it would seem, were in a very favorable position to contribute to the appraisal of the process employed in achieving certain goals for directed teaching.

As mentioned earlier, "effect" is one standard for judging the value of supervision. "Effect" may be interpreted as the degree to which methods and procedures used in the supervisory process contribute to the development of the right kind of teachers.[10]

We have conceived the job of supervision as the improvement of teaching; we have attempted to build up in our student teachers attitudes of understanding, critical judgment, and high standards towards teaching as well as skill in the actual teaching process. We believe

[10] Department of Supervisors, *op. cit.*, p. 15.

firmly in the importance of evaluation and the integrity of the student teachers supervised. Is it not reasonable to believe, then, that one way of evaluating the effectiveness of supervision for student teachers is to study their responses as graduates and experienced teachers to the type of supervisory activities they experienced? We think so; all good teachers know that much can be learned from their students.

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A Comparative Anthropometric Study of Hard Labor During Youth as a Stimulator of Physical Growth of Young Colored Women

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THE PROBLEM

THIS study attempts to determine the effects of hard labor as a stimulator of physical growth in young colored women by comparing measurements of one hundred young women who have undergone a lifetime of hard manual work with the corresponding body measurements of one hundred young women who have done no hard manual work.

SIGNIFICANCE TO PHYSICAL EDUCATION

We might ask two questions that will denote the significance of this problem to physical education for women. (1) Does a heavy dosage of physical exercise apparently stimulate growth in these women more than does a very light dosage of exercise? (2) It has been shown from data collected on young white adults that there are a number of striking sex differences in build and development. It is possible that part of these differences may not be true sex differences but are due simply to the fact that the girls and women have had less stimulus to growth because of a less severe regimen of exercise. Are these true sex differences or are they due to the absence of a more strenuous type of exercise? This study attempts to answer these two questions.

SUBJECTS

Two types of women were chosen for this investigation. One group was composed of young women who had not done any laborious work. The other group was composed of women who had necessarily had to do laborious work since an early age. Those in the first group had led the typical life of the unemployed girl, their activities being those of school life or general housework. Those in the second group worked daily from ten to twelve hours during the farming seasons, which usually last almost the year round in the South.

The age range in both groups varied between seventeen and twenty-one years of age. The number of individual cases investigated in each group was one hundred.

The non-working subjects were a heterogeneous group from Alabama and Louisiana. They represented the type of individual that makes up the better or higher class of Negroes. They had been well-cared for throughout life. They came from good homes, had been well nourished, educated, and had done no laborious work at any time during their lives.

The hard working subjects' data were collected by a series of plantation-to-plantation canvasses through Alabama, Louisiana, and Mississippi. From three to eight subjects were measured on each trip.

The hard working subjects represented the lower class of Negroes, many of whom had never had the privileges of a well kept home or a liberal education. They had not been so well nourished as the non-working group. Most of the advantages of modern living were denied them.

These measurements were obtained through the cooperation of Mrs. F. O. Johnson, who took all of the measurements.

MEASUREMENTS TAKEN[1]

Height: Standing
Shoulders: Biacromial
Chest: Width
Depth
Circumference
Hips: Bi-iliac
Bitrochanteric
Joint Breadths: Elbow
Knee
Muscle Girths: Upper Arm
Forearm
Thigh
Calf
Skin: Arm Front
Arm Back
Chest Front
Thelium-Omphalion
Supra-iliac
Weight:

ANALYSIS OF DATA

The data on hard working subjects and non-working subjects were kept separated throughout this study.

All of the measurements were taken in centimeters, except weight, which was taken in pounds. A difference between the two groups which gave a critical ratio of 2.4 or over was considered a reliable difference.

Analysis of Indices.—In order to get the indices, each measurement, with the exception of the skin measurements, was divided by height and multiplied by 100. The indices are, in other words, in terms of a percentage of height, except weight, for which the cube root of weight was used. A distribution of each measurement relative to height was made. The means and standard deviations were computed and the standard error of the difference of the means and the critical ratio for each measurement was found. These will be found in Table I.

[1] For technique consult C. H. McCloy, *Appraising Physical Status: The Selection of Measurements.* University of Iowa Studies in Child Welfare, (Iowa City, Iowa: Child Welfare Research Station), XII, 2. The chest measurement was taken just *above* the breasts, hence is not comparable with the chest measurements of the white subjects whose averages are cited in Table III.

TABLE I
INDEX NUMBERS

Measurements	S.D. Non-Work	S.D. Working	Means Non-Work	Means Working	Diff. Means	Diff. of Means	Critical Ratio
Shoulders:							
Biacromial	1.52	1.29	21.38	21.76	.38	.20	1.93
Chest:							
Width	.96	1.01	15.39	15.73	.35	.10	2.47
Depth	.91	.79	10.69	10.66	.03	—.12*	.27
Circumference	3.19	3.37	49.02	49.43	.41	.46	.89
Hips:							
Bi-iliac	2.57	1.06	16.47	16.32	.14	—.28*	.52
Bitrochanteric	1.50	1.74	25.18	20.40	.25	—.23*	1.09
Joint Breadths:							
Elbow	.29	.30	3.66	3.68	.03	.04	.60
Knee	.52	.44	5.39	5.56	.17	.07	2.49
Muscle Girths:							
Upper Arm	1.48	1.79	14.69	15.17	.48	.23	2.08
Forearm	.96	.61	13.97	14.33	.37	.14	2.63
Thigh	3.60	3.72	35.77	37.29	1.52	.52	2.94
Calf	1.70	1.85	20.51	20.62	.11	.25	.45
Weight:	.44	.48	3.04	3.09	.05	.21	.26

*The ones marked with a minus sign are in favor of the non-working subjects.

The measurements that seem to show the most reliable difference in favor of the hard working subjects are, as might be expected, the muscle girths, all of which have a critical ratio greater than 2. with the exception of the girth of the calf.

Of the chest measurements, two are in favor of the hard working subjects, although width is the only one that has a critical ratio large enough to be considered reliable. Chest depth has a critical ratio in favor of the non-working subjects but it is so small that it is not considered reliable and may be due to mere chance.

The critical ratios of both of the hip measurements are too low to be considered reliable. Bi-iliac is in favor of the non-working subjects with a critical ratio of .5181. Bitrochanteric is in favor of the hard working subjects with a critical ratio of 1.0913.

The joint breadths are both in favor of the hard working subjects but the knee, which has a critical ratio of 2.4941, is the only one that can be considered reliable. The cube root of weight divided by height has a difference in favor of the hard working subject but is entirely too low to be considered reliable.

Analysis of Actual Measurements.—A distribution was made of each of the actual measurements, mean, standard deviations, and the standard error of the difference of the means were computed and the critical ratio for each measurement was found. These are found in Table II.

TABLE II
ACTUAL MEASUREMENTS

Measurements	S.D. Non-Work	S.D. Work	Means Non-Work	Means Work	Means Non-Work*	Diff. Means	Diff. of Means	Critical Ratio
Shoulders:								
Biacromial	2.71	2.31	34.70	35.02	35.30	.60	.36	1.67
Chest:								
Width	1.51	1.50	24.42	25.21	25.50	1.08	.21	5.07
Depth	1.49	1.45	17.18	17.51	17.32	.14	.21	.68
Circumference	4.50	4.57	78.50	80.30	80.33	1.84	.65	2.83
Hips:								
Bi-iliac	1.72	1.89	26.23	26.97	26.46	.14	.55	.26
Bitrochanteric	2.32	2.63	33.37	34.05	33.42	1.06	.35	3.01
Joint Breadths:								
Elbow	.43	.49	5.89	5.99	5.98	.10	.07	1.51
Knee	.83	.70	8.63	8.82	9.01	.38	.11	3.51
Muscle Girths:								
Upper Arm	2.27	2.52	23.84	24.05	24.65	.82	.33	2.41
Forearm	1.33	1.58	22.44	23.04	23.37	.93	.21	4.43
Thigh	5.67	5.48	58.02	58.58	60.40	2.37	.79	3.01
Calf	2.60	2.74	32.88	33.60	33.44	.56	.38	1.48
Skin: Arm Front	2.55	2.43	14.16	14.38	14.40	.24	.35	.68
Arm Back	4.89	4.30	20.41	20.79	20.69	.28	.65	.43
Chest Front	3.41	3.41	16.64	17.00	16.30	.34	.48	.71
Chest Back	3.59	3.86	18.97	19.97	18.45	.52	.53	.99
Thelium Omphalion	3.56	4.09	19.51	19.10	18.98	.53	.54	.98
Supra-iliac	4.41	4.24	21.59	21.89	22.00	.41	.61	.67
Height:	5.02	6.04	160.34	163.80	163.80	3.46	.79	4.41
Weight:	16.50	17.38	117.81	125.	126.57	8.76	2.40	3.65

*This column was computed by multiplying all of the mean measurements of the non-working group by 1.0216 the proportionate difference in the heights. The weight was found by converting the ponderal index.

In the analysis of actual measurements, there is a difference *in every case* in favor of the hard working subject, except in the thelium-omphalion fat measurement. There are nine out of the twenty measurements that show a reliable difference.

Chest width and circumference show a distinct and reliable difference in favor of the hard working subjects, and depth, which shows a slight unreliable difference in favor of the non-working subjects in the indices, shows a slight unreliable difference in favor of the hard workers in the actual measurements. Height with a critical ratio of 4.408 shows a most reliable difference in favor of the hard working subjects.

The muscle girths show a distinct reliable difference in three of the measurements; they are forearm, upper arm, and thigh. Calf has a critical ratio of 1.462 which is too small to be considered reliable. Weight shows a reliable difference in favor of the hard working subjects. In the hip measurements only one can be considered reliable and that is bitrochanteric with a critical ratio of 3.014 in favor of the hard working

subjects. Bi-iliac width, which shows a small unreliable difference in favor of the non-working subjects in the indices, also shows a small unreliable difference in favor of the non-working subjects in the actual measurements.

Joint Breadths: The knee shows a very distinct and reliable difference in favor of the hard working subjects. The elbow, with a critical ratio of 1.508, is too small to be considered reliable, although it is in favor of the hard working subjects. Biacromial shoulder width has a critical ratio of 1.674 in favor of the hard working subjects, but this is too small to be reliable.

All skin measurements but one show a critical ratio less than 1.00 in favor of the hard working subjects. Therefore, the differences in fat are all considered unreliable.

In the fifth column in Table II, we have recorded the measurements of the non-working women converted proportionately to correspond to the height of the average working women. It will be seen that the differences between the two groups are slight indeed. The fact that these differences are not the same as the averages of the index numbers is due to the fact that the averages of index numbers do not necessarily correspond to an index number made from averages. The important fact is that there is practically no essential difference between the working and non-working groups except size as a whole, not size in any one specific measurement.

Analysis of Table III.—Sex Differences: The data of this study and data from the men and women freshmen white students of the State University of Iowa are combined in Table III. The averages are here in the form of percentages of height. We have tabulated the differences found between the white men and women. While we do not have analogous data for the colored men, we may probably validly assume that the difference between the colored males and females should be somewhat of the same order. We have also tabulated the differences found between the indices of the non-working and the working groups of women from our study. In the last column, these differences are given in percentages of the differences found in the same measurements between the sexes in the white subjects.

It will be found that shoulder width in the working group is very much larger, in these terms, than is that of the non-working group, and is 77 percent of the distance from women's to men's figures. The chest measurements are not directly comparable, as they were taken using a different technique, but there is no significant difference between the groups that would indicate that there was a trend towards masculinity of build in the working group.

The hips of the working group are smaller, in proportion, than those of the men, but this large percentage difference on the masculine side is possibly spurious, as the data from the Iowa women and men show a

TABLE III

SEX DIFFERENCES OF WHITE ADULT COLLEGE FRESHMEN, AS COMPARED TO THE DATA OF THIS STUDY

(Index numbers in percentages of height, except for fat measurements which are actual averages.)

	White men	Difference White women and men	White women*	Non-working women	Diff. non-hard	Hard working women†	
Shoulders:							
Biacromial	22.03	.45	21.48	21.38	.348	21.76	77
Chest:							
Width	16.29	1.20	15.49	15.49	.345	15.73	29
Depth	11.63	.63	11.00	10.69	—.032	10.66	5
Circumference	47.90	3.35	44.55	49.02	.412	49.43	12
Hips:							
Bi-iliac	16.52	.03	16.55	16.47	—.144	16.32	475
Joint Breadths:							
Elbow	4.49	.79	3.70	3.66	.025	3.68	3
Knee	5.60	.03	5.63	5.39	.169	5.56	—556
Muscle Girths:							
Upper Arm	15.17	1.05	14.12	14.69	.438	15.17	42
Forearm	14.65	1.00	13.65	13.97	.365	14.33	36
Thigh	30.16	2.44	32.60	35.77	1.521	37.29	—62
Calf	20.20	.05	20.25	20.51	.114	20.62	228
Skin and Fat Actual Meas.:							
Arm Front	16.27		21.97	14.16		14.40	
Arm Back	18.00		22.97	20.41		20.69	
Chest Front	13.35		19.18	16.64		16.30	
Chest Back	16.50		25.01	18.97		18.45	
Weight:	3.02		3.05	3.04		3.09	

*Unpublished study by Child Welfare Research Station; State University of Iowa, Iowa City, Iowa.

†This column represents the difference between working and non-working groups of colored women in percentages of the differences between white men and women. Thus 64 per cent (Shoulder) means that the widths of shoulders of the working women are greater than those of the non-working women to the extent of 64 per cent of the difference found between white men and women.

smaller difference in average hip widths than is usually found, and smaller than that found in other groups measured in the Iowa Child Welfare Research Station.

The muscle girths of all but the calf are decidedly larger than those of the non-working group, but we would expect this result, and should consider it not a sex difference but simply normal hypertrophy.

It is significant that the elbow is not larger in the working group. One might think the elbow would be apt to be developed in the working group if such labor tended to minimize sex differences.

On the whole, no evidence is found to substantiate the belief that such hard exercise on the part of women would tend to a more mascu-

line build, with the exception of slightly enlarging the width of the shoulders, slightly reducing the size of the hips, and slightly enlarging the muscle girths. None of these parts are close enough to the masculine build to be significant and therefore we cannot conclude that such work produces a tendency toward masculinity.

CONCLUSIONS

Hard labor apparently has a definite effect during youth as a stimulator of physical growth in the following ways:

It is found that the hard working women grow taller than the non-working women. They are much heavier than the non-working women. They have larger muscle girths due to constant exercising of the muscles by work and so are better developed. Their chest exceeds the non-workers' in all measurements, which leads to the conclusion that the chest is also better developed in the hard workers. The knee joint and the hip width bitrochanteric are stimulated by hard labor and are better developed.

The skin measurements (chest depth, shoulders, biacromial) and hips (bi-iliac) all seem not to be stimulated to greater physical growth and development by hard labor, although all but one show a difference in favor of the hard working subjects. The difference is too small to enable one to conclude that this is due to the stimulation of hard work.

Therefore, as a general conclusion, it is probably safe to say that constant exercising of a body part through hard labor or through any other form of exercise which is strenuous enough to stimulate these parts into extremely vigorous action will cause these parts to grow and develop more than they would grow had they not had this exercise, providing the exercising of these parts is not carried to an extreme.

Measurement of the Velocity Factor and of Athletic Power in High School Boys

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INTRODUCTION

INDIVIDUALIZATION in education depends on accurate appraisal of fundamental abilities resulting in knowledge of the true needs and potentialities of each student. Dr. J. F. Williams has stated [1] that a better understanding of fundamental physical abilities is essential to improvement of the physical education program. This means that the methods of science involving analysis and simplification into underlying categories should be applied to physical abilities as to any other aspects of human behavior. Self-understanding and responsibility for his own development on the part of each student would be made possible by such knowledge. The teacher's vision would be much clearer. The difficulty in the past has been to determine just what the fundamental components of our physical abilities were and how they might be evaluated. Tests have included a combination of these unitary factors or, as in the case of strength, have been complicated by a variety of units which had no common basis of comparison. Application of modern scientific procedures to these tests means that they must be broken down into their simpler underlying categories, the unitary physical factors, and the part played by each component in successful physical accomplishment be measured. This has not been accomplished by direct measurement of these components. A more technical procedure seems indicated.

In the field of mental testing Spearman's two-factor method of statistical analysis [25, 9 *] was first used to indicate an underlying order in the inter-correlations of a set of tests. This method was applied to a battery of physical tests by Jones[12] in 1934 and by Roggen in 1935.[22] Thurstone's multiple factor method of analysis[27, 28] was used by C. H. McCloy in 1934.[18] In 1935 E. McCloy[20] compared various methods of factor analysis and reported that Thurstone's method was the more desirable for events of the athletic type in which complex abilities were to be resolved into simpler elements. This method "success-

[1] Lecture, "Principles of Physical Education," summer, 1927.
* Numbers refer to bibliography at the end.

fully locates the separate factors involved in each ability and indicates the degree to which the complex performance is accounted for by each factor." (20: 114). Examination of the methods of Hotelling [10] and of Kelley,[18] which is similar, indicated that Thurstone's procedure was more practical because of economy of time and the more exact interpretation of factors made possible by the rotation of axes.

Because factor analysis studies are complicated and time-consuming each one must be devoted to a very limited area and the results of many such studies brought together to form a related pattern by means of which the various primary physical components may be understood and evaluated. By relating new studies to studies previously made the identification of factors is more certain. McCloy [17] has already shown that athletic power is composed of a force or strength factor and a velocity factor related to speed of muscle contraction. Physiologists have long known that muscles varied in their speed of contraction (11: 27). Some people have great strength but little power as measured by success in athletic events. Others have great speed of movement but also lack power. Proper combination of the two is needed for best athletic accomplishment. Of these two factors the one about which the least has been known is the velocity factor. This needed to be studied under a variety of conditions as one of the primary components surest of identification and most commonly related to accomplishment in physical activities. Such information would provide a foundation for study of other primary factors even less well known as such at present, thus gradually forming a complete picture of the unitary abilities which acting together produce successful physical accomplishment. The study of psychic factors involved in such accomplishment might even be a future development for either psychologists or physical educators.

Definitions. For purpose of this study the following definitions will apply:

"Athletic Power" is that combination of strength and speed of action in muscle tissue which produces the power element essential to successful accomplishment in events of the track and field type.

"Muscle Velocity" (also called "the Velocity factor") is that primary physical factor which, with strength, produces "Athletic Power."

PURPOSE OF THE STUDY

By applying Thurstone's method of multiple factor analysis to a battery of well known tests commonly used in physical education, together with certain additional differentiating tests to aid in identification this study proposes:

1. To determine certain primary components or factors essential to accomplishment in these tests.

2. To determine the relation of the Velocity factor to other primary factors in developing Athletic Power.

3. To develop a predictive measure of Muscle Velocity and of Athletic Power in high school boys by means of simple tests commonly used in physical education.

A detailed review of testing studies and procedures in the various areas of human behavior is not especially pertinent to this study. Nor will a review of the various tests now used in physical education be especially helpful in this problem except where specifically referred to later. Anyone desiring such extensive review will find it in the dissertation by Jones.[12] The investigations which are definitely related to this study as applying factor analysis techniques to test data in physical education began with C. H. McCloy [18] and Jones in 1934. In the latter, use of the Spearman two-factor method of analysis indicated that there was no general factor in a battery of four anthropometric measurements and five fundamental motor skills. Roggen [22] applying the same procedure to another battery found that strength events had a common factor which was poorly related to the common factor in jump events. E. McCloy [20] in using Spearman's method of analysis with a battery of eleven variables found a common factor of Strength with four tests of that type and a common factor in four track and field events which she called Athletic Power with a definite relation between the two factors. Using Thurstone's multiple factor analysis with the same battery she found a common Strength factor related to all eleven variables, a second factor common to track and field which was designated as Velocity and which had combined with Strength in these events to produce the Athletic Power factor indicated when Spearman's method was used. A third factor was also found, common to a few of the variables, which was designated as Dead-weight or that part of total weight which does not contribute to strength. C. H. McCloy[18] had already applied multiple factor analysis to his "Motor Capacity Test" and isolated three common factors. The first he designated as Strength, the second as Velocity, and the third as doubtful but possibly Large-muscle Coordination. Subsequent studies in this area all seem to have used the Thurstone methods of multiple factor analysis. These have covered a rather diverse range of activities with results which seem to have been in general agreement. They are herewith arranged for comparison:

TABULAR COMPARISON OF FACTOR ANALYSIS STUDIES

Investigator	Year	Type of tests	Designated factors
C. H. McCloy[18]	1934	"Motor Capacity"	Strength, Velocity, Large-muscle coordination
E. McCloy[20]	1935	Strength, weight, track and field	Strength, Velocity, Dead-weight
Wendler[30]	1936	Forty tests of many common types	Strength, Velocity, Motor educability, Sensori-motor coordination

Coleman[1]	1937	Six variations of shot, weight, Sargent jump, strength	Strength, Velocity, Weight
Harris[7]	1937	Sargent jump, athletic events, obstacle race, weight, strength	Velocity, Dead-weight, Strength
Rarick[21]	1937	Reaction time, muscle latency, Sargent jump, shot, sprint, strength	Strength, Velocity, Height, Arm-strength, Dead-weight, Muscle latency

It is evident that different combinations of tests have different underlying or primary factors common to certain groups of variables. All of these studies show Strength and Muscle Velocity to be primary components in events of the athletic type, especially track and field.

Wendler[30] used loadings of the various tests on the Velocity factor as zero-order correlations to develop a regression equation with Velocity as the criterion. One combination gave a multiple correlation of 0.8375 but the tests were not practicable for every day use. Coleman[1] used a progressive series of weights for the shot put with highly selected college men. The four pound and eight pound shot with weight gave a multiple correlation of 0.880 with the Velocity factor, but he stated the need for a predictive measure using other events. Harris[7] found that a combination of broad jump, three pound shot and Strength Index with junior high school girls gave a multiple correlation of 0.9092, while Sargent jump and broad jump gave 0.8110.

None of these studies was applied to ordinary high school boys. No tables have been formulated so that predicted values might be determined directly by the average teacher. No predictive measure of the combined effect of Strength and Velocity as Athletic Power has been developed by which probable success in athletic type events might be determined through the use of a simple battery of tests already commonly used in physical education.

Rarick's study[21] was of special interest because it was an attempt to isolate and identify the various factors which govern the speed of muscular movement in man. Previous studies by Hill [8] regarding muscle viscosity, Fenn's modification regarding reflex inhibition[5] and the study by Lapp on reaction time and muscle latency[14] served as guides in the selection and analysis of twenty-two tests used on highly selected athletes. His results indicate that beyond a certain optimum Strength does not add to speed of movement in athletic events by trained athletes. Also there was relatively no correlation of the Velocity factor with strength events, reaction times or muscle thickening latencies. He reports that the Velocity factor or pure speed of muscular movement may be considered as synonymous with Hill's viscosity factor reciprocally expressed. Hill states that the work done by a muscle in shortening can

be expressed as a function of the speed of contraction by the equation

$$W = W_o(1\text{-}kv)$$

in which W_o is the work a muscle can do under greatest effort and when shortening with infinite slowness, v is the speed of shortening with a lighter load in which less work W is accomplished although the muscle still exerts maximum effort, k is a constant related to the viscous character of a muscle so that $1/k$ is the greatest possible velocity of the unloaded muscle. The selection of events in this study does not insure that the Velocity factor which is isolated corresponds exactly to the factor described above but they are at least closely related and may be the same. Reaction time is not involved in the factor since it affects results only in the dash.

PROCEDURE

The tests used in this study were given representative groups of boys from two high schools in Des Moines, Iowa, selected at random from regular physical education classes. Of the 406 boys, 165 were from the North, 241 from Roosevelt high schools. Some other members of the classes were also given the tests but records of those who did not really try or who did not complete all tests were eliminated as were those of a few who were unable to chin themselves with added weight.

Tests were selected which are commonly used in regular physical education class work or in track and field meets so that their administration is already fairly well standardized. These included the 12 pound shot put, 60 yard dash, running high jump, standing broad jump, pull-ups and dynamometer strength measurements. Some special differentiating tests were added to help identify the primary factors. These were the six pound shot put, pull-up with added weight of 25 pounds and leg lift with the same added weight. Age, height, and weight were also included. Data from these tests were then used to compute the Strength Index and a modified Physical Fitness Index.

Intercorrelations, means, and standard deviations were computed on a regular commercial basis by Hollerith machine in the statistical laboratories at the University of Iowa. All other computations were done personally using calculating machines. C-D Machine Correlation Charts[8] were used as were mimeographed forms for the Doolittle method of figuring multiple correlations. The usual checks were applied to all computations.

ADMINISTRATION OF TESTS

Standard directions for administration of the tests were used by the instructors in charge who were also given special training in those phases with which they were not familiar. The boys who took the tests were allowed to practice in advance until familiar with them. During the

actual testing, each boy was allowed to repeat any test on which he did not feel he had done his best for that day. All tests except height and weight were given again within a week or two. The best of the two measures for each test was then used as the final test score. Certain aspects of test administration need mention for purposes of record.

Age: the nearest whole month was used for computation.

Height: in stocking feet to nearest half inch.

Weight: to nearest whole pound.

Grip: with standard manuometer.* Right and left grips were combined into one measure.

Shoulder contractors and retractors: a push and pull attachment was used with the manuometer to measure these groups of muscles.

Back lift and leg lift: a standard dynamometer, carefully calibrated, was used. The procedures described by Rogers[23] for these tests were followed.

Pull-up strength or chinning strength: the test was administered as prescribed by Rogers and pull-up strength was then computed by McCloy's method[16] using the formula, strength = 1.77 (weight) + 3.42 (chins) − 46.

Strength measurements were all in pounds. Their sum was used as the Strength Index. Lung capacity was not included because it is not clearly a measure of strength. A modified Physical Fitness Index was computed by reference to a table of norms prepared for this type of Strength Index by McCloy.[19] These two indexes were included because, while they are combined or derived measures, they do not confuse the analysis so long as their nature is kept clearly in mind. So used they can help identify the primary factors and some of the relationships involved need study herein and later.

60 yard dash: done out-doors in gymnasium costume. Standard starting techniques for the dash were used. Each boy was timed individually in tenths of a second.

Standing broad jump: done on mats in-doors. Mats were fixed. Measurement was to the nearest inch.

Running high jump: done in-doors using standard track techniques of administration.

6 lb. and 12 lb. shot put: administered according to usual track regulations. Accuracy to the nearest quarter foot was required in measuring but practically all were taken to the nearest inch.

Leg lift with weight and pull-up with weight: these tests were done in the same way as before but a lead belt weighing 25 pounds was first fastened around the waist to give the added weight.

The means and standard deviations of these measurements are given in Table 1.

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* Strength testing equipment was from Narragansett Machine Company.

TABLE 1

MEANS, STANDARD DEVIATIONS, AND RELIABILITIES OF TESTS GIVEN HIGH SCHOOL BOYS, DES MOINES, IOWA

	Mean	S.D.	Reliability
1. Age (mo.)	197.2660	13.1238	
2. Weight (lbs.)	137.1946	17.4587	
3. Height (in.)	68.0813	2.7734	
4. R. and L. Grips (lbs.)	203.3473	29.9966	.9541
5. Shoulder contractors (lbs.)	79.3251	15.8337	.8962
6. Shoulder retractors (lbs.)	86.1995	16.1920	.9200
7. Back lift (lbs.)	319.2734	62.3584	.9172
8. Leg lift (lbs.)	471.0714	113.3092	.9533
9. Pull-up strength (lbs.)	230.5123	34.5329	.9894
10. Strength Index (lbs.)	1389.5172	219.0163	.9595
11. Physical Fitness Index (mod.)	0.9323	0.1070	.9379
12. 60 yd. dash (sec.)	7.9889	0.6755	.9730
13. Standing broad jump (ft.)	7.2767	0.8015	.9582
14. Running high jump (ft.)	4.4095	0.3918	.9631
15. 6 lb. shot (ft.)	36.0987	5.6809	.9675
16. 12 lb. shot (ft.)	26.6422	4.8482	.9694
17. Leg lift with weight (lb.)	466.8202	112.3692	.9596
18. Pull-up with weight (lb.)	252.7389	33.3654	.9937

Note: N = 406, age range = 13 yrs. 11 mos. to 19 yrs. 5 mos. Date of testing: North—October, 1936; Roosevelt—May, 1937. Tests given at North by A. I. McClain, at Roosevelt by A. H. Rump. $S.D._M$ is almost exactly 0.05 × (S.D.) in each case above.

RELIABILITY OF MEASUREMENT

Retest correlations were determined from the two sets of measurements. Using the average of the two measurements for each test would tend to increase reliability in the same way as doubling the length of a test so that the Spearman-Brown formula (6:419) would apply.

For purposes of this study use of the better of the two measures is even more reliable than use of the average so that corrections which were made are quite conservative. The corrected reliabilities are shown in Table 1. If desirable, the amount of variance due to error of measurement could be determined by subtracting the reliability from unity and the variance due to specific factors by subtracting the communality from the reliability for each test. The communality, Table 3, is the sum of the squares of the factor loadings. Uniqueness is that part of the variance due to specificity and error (29:63). Since these have no definite bearing on the purpose of this study they are not tabulated herein.

ANALYSIS OF DATA

Pearson product-moment correlations were computed for each test against each of the others. These intercorrelations are shown in Table 2. From these the correlation matrix was constructed. Thurstone's

TABLE 2
INTERCORRELATIONS OF THE SCORES IN EACH TEST WITH THOSE OF THE OTHER TESTS

	1	2	3	4	5	6	7	8	9
18. Chin + wt.	.3705	.9655	.5932	.6327	.4393	.5749	.5103	.5083	.9483
17. Leg + wt.	.2493	.4476	.4270	.5148	.2798	.4028	.5317	.8063	.5016
16. 12 lb. shot	.3828	.5983	.4202	.5688	.4365	.4929	.4586	.4947	.6630
15. 6 lb. shot	.3811	.5711	.3630	.5136	.4105	.4459	.3864	.3481	.6254
14. R. H. J.	.2825	.2244	.4011	.3302	.1744	.2748	.2558	.2752	.3316
13. S. B. J.	.2605	.2670	.3659	.4313	.1964	.3154	.2983	.3452	.3897
12. Dash*	−.1836	−.2383	−.3367	−.3598	−.1648	−.2844	−.3231	−.4154	−.3650
11. P. F. I.	−.0571	−.0067	.0744	.3881	.3523	.3206	.6486	.7436	.1422
10. S. I.	.3689	.6661	.4901	.7294	.5224	.6263	.8081	.9027	.7487
9. Chin Str.	.3986	.9183	.5607	.6522	.4617	.5991	.5388	.5267	
8. Leg	.2949	.4672	.4133	.5424	.3396	.4440	.6062		
7. Back	.2328	.4727	.3368	.4966	.3835	.4251			
6. Sh. Ret.	.3500	.5217	.3111	.5121	.4784				
5. Sh. Con.	.1450	.3887	.1556	.4137					
4. R + L Grip	.3889	.5899	.4482						
3. Ht.	.2926	.6032							
2. Wt.	.3146								
1. Age									

	10	11	12	13	14	15	16	17	18
18	.7160	.0710	−.3168	.3473	.2862	.6062	.6452	.4909	
17.	.7680	.5796	−.4217	.3332	.2659	.3268	.4614		
16.	.6359	.2446	−.4318	.4107	.4044	.7579			
15.	.5226	.1193	−.2363	.3686	.3999				
14.	.3479	.1838	−.4260	.5548					
13.	.4235	.2631	−.5797						
12.	−.4456	−.3377							
11.	.6973								

* Time units were used for the computations but all negative values are changed to positive before the analysis by reflecting the variable resulting in velocity units which are retained in all tables until regression equations are developed in which the reversal to time units is made.

method of multiple factor analysis[29] was then used to secure unrotated factor loadings as shown in Table 3. Six factors seemed to be indicated by this table.

This procedure isolates the factors but does not identify them. Identification depends on proper rotation of the coordinate axes until a position is secured such that the configuration of variables in the factor space has a unique position with reference to the axes which is logical or meaningful, so that the factors represent real unitary abilities. The unique position of the configuration is usually secured when the factorial matrix has been so manipulated that the number of zero loadings is maximized, and as many non-vanishing entries as possible lie in positive quadrants. If the loadings are negative they should be logical. Knowledge of the composition of the tests aids in locating the axes.

The method of rotation which was used deals with two factors at a time rotating them about all remaining axes as a pivot. Plots are made for each pair of axes, locating positions of the variables by using their

factor loadings as coordinates. With six factors fifteen such graphs are necessary. These are then examined for obvious rotations which will tend to bring the configuration into desired position. The usual geo-

TABLE 3

UNROTATED FACTOR LOADINGS

ORIGINAL LOADINGS OBTAINED BY MULTIPLE FACTOR ANALYSIS

	I	II	III	IV	V	VI	h^2*
1. Age	.4332	.2562	.0667	.0903	.2095	−.1637	.3366
2. Wt.	.7633	.3772	−.4931	−.0820	−.0702	−.0060	.9796
3. Ht.	.5962	.2330	−.0867	−.3220	.1323	.1939	.5761
4. R + L Grip	.7657	.0559	.0514	.1323	.1703	−.0695	.6433
5. Sh. Con.	.5190	−.0591	−.0788	.3522	−.2214	−.0823	.4589
6. Sh. Ret.	.6633	.0495	−.0782	.2363	−.1033	−.1945	.5530
7. Back	.7060	−.3429	−.0883	.1658	−.0899	.3293	.7678
8. Leg	.7768	−.4597	−.0607	−.1047	.2905	−.0274	.9146
9. Chin Str.	.8550	.3000	−.2936	−.0234	−.1308	−.0838	.9318
10. S. I.	.9380	−.2810	−.1237	.0783	.0829	.0123	.9873†
11. P. F. I.	.4843	−.7780	.0823	.1022	−.0373	.0142	.8586
12. Dash‡	.5341	−.0816	.3574	−.3281	−.1956	−.1454	.5867
13. S. B. J.	.5576	.0700	.4545	−.2434	−.1266	.0128	.5978
14. R. H. J.	.4949	.1621	.4344	−.1700	−.0140	.1995	.5288
15. 6 lb. Shot	.6744	.3385	.1624	.2876	.0288	.1268	.6954
16. 12 lb. Shot	.7676	.1787	.1722	.1550	.0068	.0443	.6768
17. Leg + wt.	.7137	−.3632	−.0769	−.2113	.2566	−.0767	.7635
18. Chin + wt.	.8275	.3438	−.3899	−.0611	−.1069	−.0642	.9742

* h^2 is the square of the hypotenuse or vector and constitutes the communality which is the sum of the squares of the factor loadings.

† Strength Index is a combined score, hence the communality is greater than the reliability.

‡ Reflected to velocity units.

metrical processes for rotation of axes are used (26: 126). After each rotation the new relationships are plotted. Accuracy is checked by means of the communalities which do not change (See Tables 3 and 4) and by superimposing graphs. The new plottings are studied for desirable further rotations with new combinations of axes. In this situation nineteen such operations produced the loadings shown in Table 4 from which identification of factors was made. The communality or sum of the squares of the factor loadings is shown. The square root of the communality is the hypotenuse or vector length of each variable.

RESULTS OF THE ANALYSIS

Results from this and other studies indicate a tendency for the earlier factors to appear in the order of the number of variables they affect. Since the nature of the underlying factors depends on the selection of the tests to whose variances they contribute, there can be no constant Factor I, II or III. Other factors than actual abilities may also affect accomplishment in more than one test so that there may be negative factor loadings greater than can be explained on the basis of

sampling errors. Abilities should contribute positively while a factor like dead weight might either help or hinder.

TABLE 4
FACTOR LOADINGS AFTER ROTATION OF AXES INTO SIGNIFICANT POSITIONS

	I	II	III	IV	V	VI	h^2	Hypot-enuse
1. Age	.3204	.2079	.1694	.1493	.3365	.1627	.3366	.5802
2. Wt.	.6699	.6940	.0251	.1942	−.0051	.1055	.9798	.9898
3. Ht.	.3794	.3491	.3117	.3428	.0855	.2966	.5758	.7588
4. Grips	.6842	.0928	.2116	.1928	.2851	−.0578	.6433	.8021
5. Sh. Con.	.6312	.0436	−.0047	−.1965	−.0019	−.1409	.4588	.6773
6. Sh. Ret.	.6845	.1665	.0841	−.0064	.0743	−.2090	.5525	.7433
7. Back	.7889	−.1728	.0519	−.0074	−.0478	.3325	.7680	.8764
8. Leg	.7406	−.2513	.0560	.5366	.0376	.1021	.9145	.9563
9. Chin Str.	.7603	.5505	.1707	.1459	−.0012	−.0166	.9319	.9654
10. S. I.	.9398	−.0550	.0871	.2908	.0422	.0833	.9871	.9935
11. P. F. I.	.6319	−.6199	.0259	.1653	−.2144	.0373	.8590	.9268
12. Dash*	.3564	−.0615	.5909	.2237	−.2019	.1255	.5866	.7659
13. S. B. J.	.3438	−.0190	.6811	.1230	−.0091	−.0038	.5977	.7731
14. R. H. J.	.2781	.0126	.6329	.0591	.1517	.1547	.5289	.7273
15. 6 lb. Shot	.5857	.2333	.3330	−.1477	.4044	.0354	.6952	.8338
16. 12 lb. Shot	.6651	.1459	.3771	.0030	.2665	.0033	.6769	.8227
17. Leg + Wt.	.6361	−.1454	.0953	.5687	−.0151	.0699	.7633	.8737
18. Chin + Wt.	.7279	.6315	.1112	.1801	−.0080	.0271	.9742	.9870

* Reflected to velocity units.

The tests used for this study were chosen particularly to aid in developing a measure of the Velocity factor and the combination of Strength and Velocity to form Athletic Power. A weight was added in two events to make identification of the weight factor more probable. In the light of other investigations using somewhat similar batteries any factors other than these three which may be found should be more or less incidental and apply to few variables. Inspection of Table 4 supports such conclusions. These rotated factor loadings are zero-order correlations of each test with each of the factors. A study of the loadings of the different variables on each factor is the principal guide in identification.

Factor I is clearly general Strength. It has highest loadings with all strength events, especially the Strength Index, which is related to all the variables to some extent. Rarick[21] found that with skilled men strength beyond a certain optimum did not seem important in speed events but these data seem to indicate that with untrained high school boys it is of some importance, which agrees with results secured by Harris[7] on junior high school girls.

Factor II corresponds to what has been called "Dead-weight" in other studies but the use of weight in the formulae for computing pull-up strengths and Physical Fitness Index suggests the possibility of an arti-fact. The positive loadings on age and height with negative load-

ings on back and leg lift support the idea of a definite factor at least related to "Dead-weight," but in such case the loadings for the shot variables should be reversed in magnitude. Review of other studies shows the same possibility of doubt. Comparison of the means for pull-up strength with and without weight suggests need for revision of the formula used. Further study of this factor seems to be needed before it can be definitely called "Dead-weight" though it seems to be related to weight in some form. It is therefore simply designated as a weight factor.

Factor III is evidently the Velocity factor. The highest loadings are with the athletic events, especially the sprint and the jumps. One would expect the six pound shot to have the greater loading on the Velocity factor but this may have been counteracted by lack of skill or by a special arm strength factor. The absence of significant negative loadings further indicates this to be a definite unitary ability probably related to muscular viscosity though other influences affecting speed of movement may be involved.

Factor IV may be tentatively identified as a Structure factor, perhaps of length of leg or thigh, perhaps of leverage. It affects the two leg lifts most and through them probably influences the Strength Index. It is related to height and to the dash slightly. It probably has no special significance for this study. Factor V may be a special Arm Strength or Forearm Strength factor. It is related to the grips, shot put, and age. The latter may explain the slight negative relation to the Physical Fitness Index. It is also probably not especially significant to this study.

Factor VI may be an arti-fact or a factor whose influence is too small to show up clearly with this selection of variables. No definite identification has been attempted at present since the back lift is the only variable contributing as much as .100 to the communality.

PREDICTIVE MEASURE OF THE VELOCITY FACTOR

Strength can be determined directly by the Strength Index. It may be approximated by Pull-up Strength if complete testing equipment is lacking. No such direct measure is available for Muscle Velocity in high school boys. Measure of this factor involves the use of several variables and the formation of a satisfactory regression equation. To do this it is necessary to use the intercorrelations of the variables with each other and with the Velocity factor. The original intercorrelations involve more than the pure power factors. These extra influences can be eliminated by securing intercorrelations limited to the plane defined by the Strength and Velocity factors. It can be shown mathematically that such correlation can be secured by the formula $h_a h_b \cos A_{a-b}$ in which h_a and h_b are the vectors of two variables in that plane only expressed in terms of their factor scores and Cos A_{a-b} is the

cosine of the angle between the two vectors. The vector length is the hypotenuse computed from the two factor loadings. See Chart I. The angle of each vector with the Velocity vector is secured by using the factor loadings to determine the tangent of the angle and referring to a table of trigonometric functions. The difference between the vector angles then gives the angle for which the cosine is used. The loading of each variable or test on the Velocity factor is the zero-order correlation between the two. Table 5 shows the intercorrelations of Velocity, the five athletic events, Strength Index, pull-up strength, and weight. These were used to compute the multiple correlations and regression weightings for the different combinations of events to determine the best for use. See Table 6. Doolittle charts were used for this computation which gave the weightings in *B*'s or standard score form. These were then changed to *b*'s for use with regular test scores in the selected equations. While use of all five athletic events with Strength Index gave the highest multiple correlation, the use of the shot events does

TABLE 5

REFINED INTERCORRELATIONS FOR SELECTED VARIABLES

Events were selected which gave high multiple correlations with the Velocity factor using intercorrelations based on factor scores.

	III	2	9	10	12	13	14	15
16. 12 lb. shot	.3771	.4551	.5700	.6579	.4599	.4856	.4241	.5151
15. 6 lb. shot	.3330	.4008	.5022	.5794	.4055	.4281	.3740	
14. R. H. J.	.6329	.2026	.3200	.3171	.4734	.5270		
13. S. B. J.	.6811	.2475	.3776	.3825	.5250			
12. Dash	.5909	.2536	.3718	.3865				
10. Str. Ind.	.0871	.6317	.7294					
9. Chin Str.	.1707	.5136						
2. Weight	.0251							
III Velocity								

TABLE 6

MULTIPLE CORRELATIONS WITH VELOCITY

Key: 0—Velocity, 1—60 yard dash, 2—standing broad jump, 3—running high jump, 4—6 pound shot, 5—12 pound shot, 6—Strength Index, 7—pull-up strength, 8—weight. N = 406. Standard errors of these measures are too small to need special attention.

1. $R_{0.123456} = .8386$	7. $R_{0.126} = .7788$
2. $R_{0.12356} = .8352$	8. $R_{0.236} = .7902$
3. $R_{0.1236} = .8282$*	9. $R_{0.26} = .7065$
4. $R_{0.1265} = .7809$	10. $R_{0.23} = .7536$
5. $R_{0.123} = .7781$	11. $R_{0.1237} = .7996$
6. $R_{0.125} = .7363$	12. $R_{0.1238} = .8045$*

* Used for regression equation.

not increase predictive value enough to justify their use for ordinary purposes.

The best combination is given in equation 3 which includes events No. 12 (dash), No. 13 (standing broad jump), No. 14 (running high jump) and No. 10 (Strength Index). The addition of the latter tends to partial out strength or related factors in the athletic events. When use of the Strength Index is not desirable it can be replaced without excessive reduction of predictive value by No. 2 (weight) as in equation 12. These two equations are given with the jumps measured in feet rather than inches.

3. Velocity = 26.2514 + 5.7105 (Standing broad jump) + 8.8259 (Running high jump) — 4.5817 (60 yard dash) — 0.0145 (Strength Index)

12. Velocity = 23.7779 + 5.2389 (Standing broad jump) + 8.3486 (Running high jump) — 3.9956 (60 yard dash) — 0.1224 (Weight)

Since the Velocity factor, as used here, has no units of measure, an arbitrary mean of 50 and standard deviation of 10 were used so that results are shown in T-score form. Measurement of the Velocity factor of any high school boy can thus be made in terms of this group of Des Moines high school boys whose average is taken as 50.

Tables have been prepared from equation 12 as the most usable for general use at present so that by simply looking up the figures corresponding to the score in four events and adding them algebraically the Velocity score may be obtained.

Results from use of the two equations are shown by applying them to boy No. 211 of the original data. His measurements are: weight—132 lbs., Strength Index—1350 lbs., dash—7.3 sec., standing broad jump—7.25 feet, running high jump—4.5833 ft. The Velocity scores for these data by the two equations are No. 3—55.1, No. 12—54.7.

Boy No. 214 has a Strength Index of 1753.5 lbs. which is considerably higher than that of No. 211 yet his Velocity score is only 44.4 indicating that his greater strength does not increase his Muscle Velocity.

These measures will be applied to various high school situations to determine their general applicability over the country. Applied to college freshmen, the results were highly indicative but better measures for that area are desirable.

PREDICTIVE MEASURE OF ATHLETIC POWER

When the pure unitary factors of Strength and Velocity work together to affect accomplishment in physical activities, the result is as though a single component were acting, as has been shown in the review of some of the previous studies. This component has been defined as Athletic Power and would be represented for the kind of power used in track events by a centroid vector through the cluster of athletic events shown in Chart 1. The direction of the vector was determined by averaging the angles made by the vectors of all the athletic events

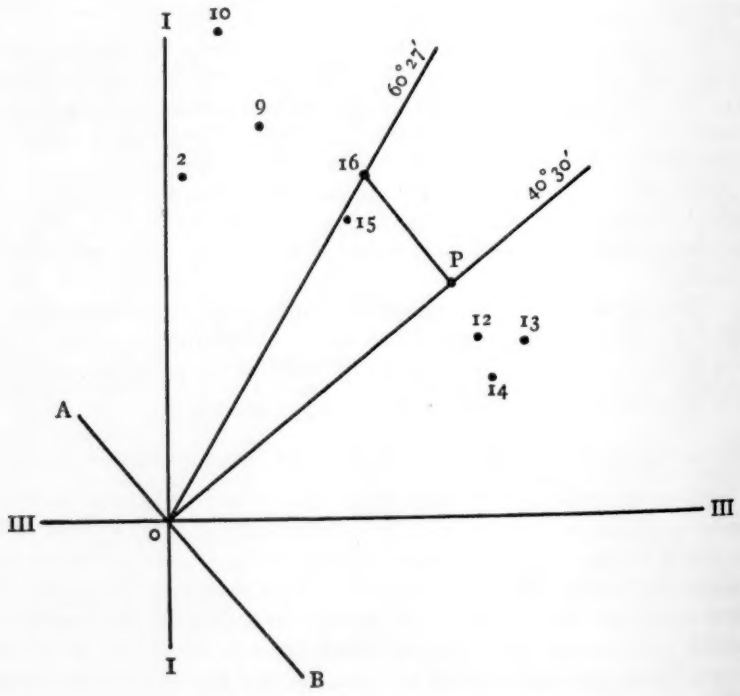
with the Velocity vector and was found to be 40° 30′. The plane of Athletic Power would be such that the Power vector is perpendicular to it as represented by *AB* in Chart 1.

Each variable or test event is represented by a point in space determined by the factor loadings on the axes of the various factors as coordinates. Considering only Strength and Velocity in relation to Athletic Power these variables are represented by the various points indicated on Chart 1. The vertical distance from each point to the plane, *AB* would give the factor loading of the variable on Athletic Power which in turn is the zero-order correlation. This loading may be measured by the projection of each vector on the Power vector. This is computed as the product of the cosine of the angle between the vectors multiplied by the hypotenuse or length of each vector. This is illus-

CHART I

DIAGRAM OF THE PLANE DEFINED BY THE STRENGTH AND VELOCITY AXES

Key: I—Strength factor, III—Velocity factor, 2—weight, 9—chin strength, 10—Strength Index, 12—60 yard dash, 13—standing broad jump, 14—running high jump, 15—6 pound shot, 16—12 pound shot, AB—power plane.



trated on Chart 1 in the case of the 12 pound shot, event No. 16. The angle of difference is 16-O-P or 19° 57′. The cosine is 0.93999 times the length of the shot put vector 0.7646 giving a factor loading of 0.7187. The loadings for all athletic events, weight, and height are shown in Table 7.

The refined intercorrelations of the variables based only on Strength and Velocity are available from the Velocity measurement. Multiple correlations were developed with Athletic Power as the criterion. These are shown in Table 8. Combining all athletic events gives a multiple correlation of 0.9131 but the dash, broad jump, high jump and 12 pound shot gives almost equally good prediction of 0.8993 and these were used for the regression equation. It should be noted that McCloy (17: 52) procured a multiple correlation of 0.918 from the same events with Chinese boys using the total score from all athletic events as a criterion. Strength events were not included in this equation since the use of variables involving only one of the underlying factors would produce a false relationship. Weight and height were tried but had very little influence in this situation.

TABLE 7

LOADINGS ON ATHLETIC POWER

Zero-order correlations of selected events with Athletic Power, using factor scores. These are used with the intercorrelations of Table 5 to compute multiple correlations of these events with Athletic Power.

16. 12 lb. shot	.7187	12. Dash	.6808
15. 6 lb. shot	.6336	3. Height	.4834
14. R. H. J.	.6623	2. Weight	.4542
13. S. B. J.	.7412		

TABLE 8

MULTIPLE CORRELATIONS WITH ATHLETIC POWER

Key: 0—Power, 1—60 yard dash, 2—standing broad jump, 3—running high jump, 4—6 pound shot, 5—12 pound shot, 8—weight, 9—height. N = 406. Standard errors of these measures are not given because so small.

1. $R_{0.12345} = .9131$	6. $R_{0.25} = .8472$
2. $R_{0.1235} = .8993$*	7. $R_{0.35} = .8074$
3. $R_{0.123} = .8498$	8. $R_{0.12358} = .9071$
4. $R_{0.2345} = .8971$	9. $R_{0.12359} = .9056$
5. $R_{0.235} = .8785$	

* Used for regression equation.

The *B*'s from the Doolittle computation were used with the standard deviations to develop the regression equation on a T— score basis by assigning a mean of 50 and standard deviation of 10 to the Power scores with the following result:

Power = 3.9890 + 4.0237 (Standing broad jump)
+ 5.8218 (Running high jump) + 0.7316
(16 pound shot) − 3.5588 (60 yard dash).

Measures are to be made in feet and seconds.

Applying this equation to the same boys as before we find that No. 214 is over eighteen years old, weighs 164 pounds, is 71.5 inches tall and has a Strength Index of 1753.5 and his Power score is only 51.8 while No. 211 is 15 years old, weighs 132 pounds, is 66.5 inches tall and has a Strength Index of 1350.2 pounds yet has a slightly greater Power score of 53.2. Comparison of Velocity scores shows that of No. 214 to be 44.4 while that of No. 211 is 55.1 which indicates the importance of this factor in producing Athletic Power. If Velocity does not vary with age then increase in power should come primarily through increased strength. This needs investigation. Boy No. 332, age 17 years, weight 165 pounds, height 71.0 inches had a Velocity score of only 54.8 but a Power score of 75.5 because his Strength Index was 2276.1 pounds. That meant that with a Muscle Velocity somewhat above the average and exceptional strength a very high Power score resulted. Boy No. 316 has a low Strength Index but his Velocity score of 62.2 explains a Power score of 60.5. If this boy should now develop his strength as did boy No. 332 he would really have something for purposes of physical accomplishment.

EDUCATIONAL IMPLICATIONS

The measures can be applied immediately in the physical education of high school boys and can be developed for similar use with students at all levels. The specific application to the former will illustrate the more general ultimate use with all groups. In using measures of this type it is important that the instructor keep their nature in mind. Such measures are indicative rather than exact. A boy with a Velocity measure of 60 is quite clearly more capable of physical accomplishment in events involving speed of muscular movement than one whose Velocity measure is 50, other factors being approximately the same, but this could not be expressed in exact terms by which you could tell just how much better one is than the other. One might make a fairly adequate prediction of the comparative scores likely to be made in events of such a type but not in exact figures.

Keeping this constantly in mind we may use these measures for such purposes as the following:

1. To secure a better appraisal of the potential physical ability of each student.

2. To help the student understand himself and his possibilities better through such appraisal.

3. To make possible the planning of the most desirable or fruitful program of physical development by teacher and pupil.

4. To determine whether a pupil is living up to his possibilities and stimulate him to better accomplishment when so indicated.

5. To help safeguard those with exceptional muscle velocity from the danger of strains and tears so common to such types.

6. To prevent waste of time and energy on the part of students and teachers in attempting to do things for which one is not physically equipped.

7. To allow opportunity for special development on the part of those who are exceptionally well equipped with such physical abilities. In many cases such abilities might be totally unrecognized except through such a measure.

These will indicate some of the possibilities; others will develop with use and according to the situation. Whenever any new tool is produced the full range of usage can only be developed through practical application in the program. Such a specific application is outlined in some what greater detail for purpose of clarification.

A group of high school boys is given a series of simple tests among which will be the dash, standing broad jump, running high jump and twelve pound shot. If a strength test is not given then weight may be used. Reference to the tables for values corresponding to the test scores allows each boy to get a fairly good idea of his Muscle Velocity and Athletic Power based on high school level of accomplishment. Each boy can now be guided in his program of development and selection of activities accordingly. If low in these abilities, he will be more likely to find success in activities where they are less important for success. The teacher will not expect too much from him. It may be that further study will show that these abilities can be improved by certain types of work if the student so desires. In grouping into squads or teams for competition these abilities may be taken into account to further insure more even contests. Boys who have never done much in athletics and who show a high rating may become interested in competing on a higher level.

In teaching neuromuscular skill more accurate knowledge regarding such abilities is especially valuable. The boy with average or low power and high contraction speed may need to go back to specific strength building work before he can master certain skills, another with low muscle velocity may be quite unable to thoroughly master a snap-up or somersault or even some of the simpler stunts. In the sport of diving he might succeed in certain slower type movements and never be very good in others requiring very rapid muscular contractions. By having this knowledge about each boy the instructor will constantly apply it in the teaching of skills to individual boys who need special help. He will keep boys with a high degree of muscular velocity from attempting certain activities before they have built up a foundation of adequate tissue structure and underlying body controls for purposes of safety.

In constructing achievement tests the ratings or evaluations may ultimately take into account these primary abilities. As study and usage further validate these measures or others found to be more accurate their functions will be more definite and valuable. Understanding of their nature will increase. Students in physical education will understand these primary abilities better by actually applying the measures and can thus do better teaching.

Future developments should include further study of the best set of tests, possibly the inclusion of such an event as the Sargent jump, so that more accurate prediction may be possible. Similar measures should be developed for all levels of both sexes. Wider application will help establish norms for the various levels and determine the possibility of improving muscle velocity. Measures of this type will not replace achievement tests in the various activities which are used for diagnosis and to measure progress but will underlie and make more meaningful the results of such tests. The one is general, functioning through many types of activity, the second is specific to the particular activity and is a measure not of one fundamental ability but of the combination of several such abilities in a coordinated or skilled effort applied in the limited field. Practice will improve such skill and give better achievement scores even though the fundamental abilities improve but little. The two types of test will thus reenforce each other in building a sounder program of physical education.

SUMMARY AND CONCLUSIONS

Eighteen tests and measurements were applied to high school boys and the results analyzed for unitary factors underlying physical accomplishment by Thurstone's method of factor analysis. The events were selected primarily for the purpose of isolating and establishing predictive measures for Muscle Velocity and for Athletic Power by a battery of commonly used tests. They included strengths of leg, back, chest, shoulders and forearms, pull-up strength, 60 yard dash, standing-broad jump, running high jump, 6 pound shot put, 12 pound shot put, leg lift with weight, pull-up strength with weight, Strength Index, age, height and weight.

1. The unitary factors which were isolated as contributing to accomplishment in these events were Strength, Weight, Muscle Velocity, a Structure factor, an Arm or Fore-arm Strength factor and an artifact or a factor too small in amount to identify.

2. A combination of the 60 yard dash, standing broad jump, running high jump, and Strength Index, which gave a multiple correlation of 0.8282 with the Velocity factor as a criterion, was selected as most usable for developing a predictive measure of that factor. An equation

was also developed whereby the Strength Index might be replaced by weight in cases where strength testing equipment is not available. The last combination is most practicable for everyday use by the average teacher.

3. A centroid vector was passed through the cluster of athletic events and the plane of Athletic Power established at right angles to it which was considered as representing the joint action of Strength and Velocity in its effect on success in athletic events.

4. Factor loadings of each variable on this plane were computed and used as zero-order correlations for developing a regression equation with the 60 yard dash, standing broad jump, running high jump and 12 pound shot on Athletic Power as a criterion with a multiple correlation of 0.8993.

5. These equations, put in proper tabular form, establish an easy and fairly accurate predictive measure of Muscle Velocity and of Athletic Power. These measures can be used by teacher and pupils to help evaluate individual needs and possibilities so that the physical education program may improve. Their use for coaching purposes is self-apparent.

As simple, easily applied measures of the underlying unitary factors affecting physical accomplishment are developed and used by an increasing number of physical education teachers, their nature will be better understood, further study will be encouraged and the scientific foundations of the profession be more definitely established.

(E.N.: An Appendix containing tables for computing Muscle Velocity and Athletic Power, may be secured from the author.)

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A Bibliography on Boxing

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THIS list of titles on boxing covers books, pamphlets, and parts of books published in the English language from the middle of the eighteenth century to the present time. All items found have been included. Wherever possible, an annotation is given if the title does not clearly indicate the content. Works followed by an "X" are owned by the Library of Congress.

ABBREVIATIONS

A. L. A. American Library Association.
B. R. D. Book Review Digest.
L. C. Library of Congress.
V. F. S. Vertical File Service.
W. L. B. Wilson Library Bulletin.

CONTENTS

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63. Egan, Pierce. "Lord Byron's Taste for Boxing." (In his *Book of Sports and Mirror of Life.* London, Printed for W. Tegg, 1847. p. 13–14) X In double columns.
64. Egan, Pierce. "On the Usefulness of Pugilism." (In his *Book of Sports and Mirror of Life.* London, Printed for W. Tegg, 1847. p. 11–13) X In double columns.
65. Gerould, Katharine (Fullerton) "Mrs. Gordon Hall Gerould." "Ringside Seat." (In Rankin, T. E. and others, eds. *Further Adventures in Essay Reading.* New York, Harcourt, 1928. p. 307–21) X A "poetization" of the Dempsey-Tunney fight.
66. Hazlitt, William. "The Fight." (In his *Selected Essays;* ed. by George Sampson, Cambridge, Eng., University Press, 1917. p. 109–35) X The combat between Thomas Hickman, known as Gasman, and Bill Neate.
67. Latymer, Francis Burdett Thomas Coutts-Nevill, baron. "Sport." (In his *Ventures in Thought.* London, Lane, 1915. p. 217–20) X Boxing is compared to bullfighting, both, according to the author, uncivilized.
68. McCarthy, Desmond (Affable Hawk, pseud.) "Boxing." (In his *Experience.* New York, Oxford University Press, 1935. p. 157–61) X Impressions of one who enjoys seeing a match.
69. Maeterlinck, Maurice. "In Praise of the Fist." (In his *Measures of the Hours;* tr. by A. T. de Mattos. New York, Dodd, 1907. p. 197-210) X The writer would like to see more men adept in the art of boxing.
70. Merz, Charles. "Ringside." (In his *The Great American Band Wagon.* New York, J. Day, 1928. p. 201–12) X Tells how boxing has become "big business."
71. Miles, Septimus. "Lecture on Pugilism;" delivered at the Society for Mutual Improvement, established by Jeremy Bentham, esq. at No. 52, Great Malborough Street, Oxford Street, April 14th, 1820. London, White, 1820. 24 p. "This curious and elaborate defence of pugilism seems rather to have been a rhetorical exercitation for discussion at a debating society than a defence." Miles, H. Pugilistica.
72. Mitchell, Jonathan. "Joe Louis Never Smiles." (In *Essay Annual,* 1936; ed. by E. A. Walter. Chicago, Scott, Foresman, 1936. p. 115–20) X The Louis-Baer match as told by a contributing editor of the New Republic.
73. Morley, Christopher Darlington. "Dempsey vs. Carpentier." (In his *Plum Pudding.* New York, Doubleday, Page, 1921. p. 234–38) X
74. "On Fighting"; by a young gentleman of the fancy. (In Egan, Pierce. *Book of Sports and Mirror of Life.* London, Printed for W. Tegg, 1847. p. 120–24) X In double columns. A eulogy of fighting in general and of boxing in particular.
75. Priestley, John Boynton. "Ring." (In his *Self-selected Essays.* New York Harper, 1932. p. 19–25) X A description of several bouts at the Ring, a boxing-hall in Blackfriars Road, London.
76. Reynolds, Tom. "Pugilism Defended." (In Egan, Pierce. *Book of Sports and Mirror of Life.* London, Printed for W. Tegg, 1847. p. 170–72) X In double columns.
77. Shaw, George Bernard. "The Great Fight;" by the author of "Cashel Byron's Profession." London, M. Kennerley, 1921. 14 p. "Account of the fight between Beckett and Carpentier."

SHORT STORIES

78. Doyle, Sir Arthur Conan. "The Bully of Brocas Court." (In his *The Croxley Master and Other Tales of the Ring and Camp*. New York, Doran, 1925. p. 149–65) X An unexpected encounter in which a young professional outfights a famous veteran.
79. Doyle, Sir Arthur Conan. "The Croxley Master." (In his *The Croxley Master and Other Tales of the Ring and Camp*. New York, Doran, 1925. p. 9–64) X An impoverished student whips the master of Croxley and earns enough money to obtain the coveted degree.
80. Doyle, Sir Arthur Conan. "The Fall of Lord Barrymore." (In his *The Croxley Master and Other Tales of the Ring and Camp*. New York, Doran, 1925. p. 97–112) X An ingenious scheme whereby an Oxford student reestablishes his uncle's prestige.
81. Doyle, Sir Arthur Conan. "The Lord of Falconbridge"; a legend of the ring. (In his *The Croxley Master and Other Tales of the Ring and Camp*. New York, Doran, 1925. p. 65–95) X A fight between a professional and a nobleman, connived by the latter's estranged wife.
82. Hemingway, Ernest. "The Battler." (In his *In Our Time*. New York, Scribner's, 1930. p. 65–79) X A curious meeting between a negro, an ex-champion, and a young tramp.
83. Hemingway, Ernest. "Fifty Grand." (In his *Men without Women*. New York, Scribner's, 1932. p. 115–61) X A champion gone stale bets two to one on his opponent in a title fight and wins "fifty grand."
84. London, Jack. "A Piece of Steak." (In his *Selected Stories*. New York, World Syndicate Publishing Co., 1930. p. 279–319) X A vivid description of a fight between an old ex-champion and a young favorite.
85. London, Jack. "The Story of a Smile." (In Rice, Grantland and Powell, H. W. H., ed. *Omnibus of Sport*. New York, Harper, 1932. p. 505–13) X "Jack Johnson v. Jim Jeffries," feature story, syndicated by the New York Herald.
86. Pegler, Westbrook. "Guilty?" (In Rice, Grantland and Powell, H. W. H., eds *Omnibus of Sport*. New York, Harper, 1932. p. 580–83) X "Philadelphia, June 24, 1930, feature story of the Godfrey-Carnera fight."
87. Porter, William Sydney (O. Henry, pseud.) "The Higher Pragmatism." (In his *Options*. New York, Harper, 1909. p. 250–63) X An amateur lover takes a lesson from an amateur boxer.

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88. Burnett, William Riley. *Iron Man*. New York, Dial Press, 1930. 312 p. X The story of a first-rate middle weight prize fighter who becomes a champion, then goes to defeat, mostly because of a worthless wife.
89. Carpentier, Georges. *Brothers of the Brown Owl;* a story of the boxing ring; with four colour plates and numerous black-and-white illustrations by George Bates. London, Cassell, 1921. 275 p. X Handicapped in every fight, yet Henri Lamont wins his way to the heavyweight championship and unwittingly aids Scotland Yard in the apprehension of a gang of terrorists.
90. Cary, Lucian. *The Duke Comes Back*. New York, Doubleday, Doran, 1933. 277 p. X "Duke Wellington, the young pugilist hero of *The Duke Steps Out*, had need of a large sum of money, and altho he had promised Susan never to enter the ring again, he was obliged to break his word. His last fight was a complete success, thanks to Susan." B.R.D.
91. Cary, Lucian. *The Duke Steps Out*. New York, Burt, 1930. 288 p. X "A rather superior prize-fighter goes to college incognito because he has fallen in love with a striking young co-ed. Difficulties of every kind beset

him; the girl's father is particularly hard to convince. When the big fight of his career comes off he finds himself suddenly startlingly successful in his love affair too." B.R.D.

92. Coe, Charles Francis. *Knockout.* Philadelphia, Lippincott, 1936. 319 p. X "Few popular novelists can unravel the fringes of the underworld — the twilight zone of gamblers, fighters, promoters and fixers — with as much dexterity and verbal vigor as Charles Francis Coe. . . Here's a crisp and unvarnished yarn from inside the ropes." B.R.D.
93. Curtis, James. *There Ain't no Justice.* New York, Knopf, 1937. 306 p. "How a young boy, with fairly decent standard, finds that he must adopt dishonest methods in order to advance up the ladder to success in the boxing world of London's slums." B.R.D.
94. Doyle, Sir Arthur Conan. *Rodney Stone.* New York, Appleton, 1924. 408 p. X A considerable part of the story concerns the "Corinthians" and prominent fighters of the early nineteenth century.
95. Herring, Paul. *Bold Bendigo;* a romance of the open road. Philadelphia, Lippincott, 1927. 318 p. X "The history of a brawny lad who followed the boxing ring from town to town and fair to fair, wearing his mother's colors in the birdseye knotted about his neck, and carrying a gypsy girl's likeness in his heart. He lost his Romany sweetheart to a wealthy blade, but in a series of lusty bouts he won the champion's belt and was consoled." B.R.D.
96. London, Jack. *The Game;* with illustrations and decorations by Henry Hutt and T. C. Lawrence. New York, Macmillan, 1905. 182 p. X An appealing, if somewhat credulous, story of a prizefighter and a shop girl.
97. McKenna, Edward L. *The Bruiser.* New York, McBride, 1929. 329 p. X "Clancy is the product of a Baltimore orphan asylum, graduated to stable boy, and from there shoved into the ring. . . Ignorant, superstitious, sure of himself and with matchless courage, Clancy fought to the end with only his right and his sense of fair play to aid him." B.R.D.
98. Neville, James Mandeville. *Rich Irish.* New York, Coward-McCann, 1931. 320 p. X "The story of a young college athlete who becomes a professional prize fighter." B.R.D.
99. Skene, Don. *Red Tiger;* illus. by Howard Baer. New York, Appleton-Century, 1934. 196 p. X "Satirical account of the rise and decline of a heavyweight fighter, who was transformed from Merle Gillingwater, canary-bird salesman into James J. Clancy, known as the Red Tiger of the Rockies." B.R.D.
100. Tully, Jim. *The Bruiser.* New York, Greenberg, 1936. 248 p. X "The hero, young Shane Rory, heavyweight hopeful, starts his fighting career via the hobo route, as a small-time boxer, proceeding steadily toward fame and big money, under the guidance of a shrewd old manager, to the final winning of the world's championship." B.R.D.
101. Van Loon, Charles Emmett. *Inside the Ropes.* Boston, Small, 1913. 411 p. illus.
102. Vergani, Orio. *Poor Nigger;* tr. from the Italian by W. W. Hobson. Indianapolis, Ind., Bobbs-Merrill, 1930. 306 p. X A novel based on the life of Battling Siki, the Senegalese prize fighter.
103. Wallace, Francis. *Kid Galahad.* Boston, Little, Brown, 1936. 286 p. X "This story of the rise of prize fighter begins in a Miami hotel room where a green bell-hop floors a champion. It closes with a championship match in New York two years later. The plot is primarily concerned with the building up of the bell-hop, known as Kid Galahad, but it includes some gangster intrigue and two romances." B.R.D.
104. Ward, Millard. *Brute.* New York, Appleton-Century, 1935. 248 p. X "The story of a boy from a Nebraska farm, of his years as student at Annapolis where his physical prowess won him renown, of his dismissal from the Academy, and his rise to fame as a heavy-weight champion. Woven into the

story is the account of his love for three women of very different types." B.R.D.

105. Witwer, Harry Charles. *Fighting Back;* a sequel to *The Leather Pushers;* illus. with scenes from the photo-play. New York, Grosset & Dunlap, 1924. 339 p.

106. Witwer, Harry Charles. *Fighting Blood.* New York, Putnam, 1923. 377 p. X "Another prize-fighting story like the *Leather Pushers,* told in the style of Ring Lardner. One thrilling battle after another leads the hero to the heavyweight championship of the world and there is a romance." B.R.D.

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108. Witwer, Harry Charles. *Leather Pushers.* New York, Grosset & Dunlap, 1921. 341 p.

109. Wren, Percival Christopher. *Soldiers of Misfortune;* the story of Otho Bellême who loved chivalry, truth and honor, freedom and courtesy but was headstrong, stubborn, romantical, and most unwise. New York, Stokes, 1929. 366 p. X "The prize ring is important in 'Soldiers of Misfortune.' Otho is a remarkable boxer, and his fights fill many pages of the book."

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110. Andes, William Francis. *The Leather Pushers Guide,* by Jack Dillon, alias Willie Andes. Hot Springs, Ark., J. M. Connelly Printing Co., 1927. 30 p. illus. X Short sketches of boxers.

111. *Career of the Champions;* a reliable history of Tom Sayers and John C. Heenan, and their achievements in the ring; collated from Bell's life in London, Boxiana, Porter's spirit of the times, the Clipper, Wilkes' spirit of the times, and other reliable authorities; together with a full and authentic report of the great fight for the championship of the two hemispheres, between Sayers and Heenan, in April, 1860; and the rules of the prize ring. New York, F. A. Brady, 1860? 105 p. illus. X In double columns.

112. Carpentier, Georges. *My Fighting Life.* London, Cassell, 1920, 253 p. illus. X

113. Corbett, James John. *My Life and My Fights.* London, J. Ouseley, 1910. 125 p.

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117. Darwin, Bernard Richard Meirion. *John Gully and his Times.* New York, Harper, 1935. 230 p. illus. X "John Gully was a colorful figure in early nineteenth-century England. After an obscure childhood and youth, he became in turn a successful prize fighter, bookmaker and race horse owner. He was once elected to parliament and later won a fortune in business and retired as a landed gentleman. His biographer's interest lies chiefly in the life of the sporting world of his times and his relations to it." B.R.D.

118. *Death and Memoirs of J. C. Heenan and T. Sayers;* with accurate account of the great fight for the championship from "Bell's Life in London," April 22, 1860. London, 1873.

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125. Fleischer, Nathaniel S. *Gene Tunney, the Enigma of the Ring.* New York, Ring, 1931. 127 p. illus. (Ring athletic library, No. 6) X

126. Fleischer, Nathaniel S. *Jack Dempsey, the Idol of Fistiana;* an intimate narrative. New York, Ring, 1929. 309 p. (Ring athletic library, No. 5) X

127. Fleischer, Nathaniel S. *Jack Dempsey, the Idol of Fistiana;* an intimate narrative with numerous illustrations; rev. ed. New York, Press of C. J. O'Brien, 1936. 157 p. (Ring athletic library book No. 12) X

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136. Harding, William Edgar. *Jake Kilrain's Life and Battles;* also, a complete history of the great international prize fight with Jim Smith. New York, R. K. Fox, 1888. 42 p. illus. X

137. Harding, William Edgar, comp. *Jem Mace of Norwich, England, Champion Pugilist of the World;* his life and battles, with portraits and illustrations; 3d ed. New York, R. K. Fox, 1881. 51 p. (Fistiana's heroes, No. 1) X

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145. Inglis, William O. *Champions Off Guard.* New York. Vanguard Press, 1932. 311 p. illus. X Contents.—Of Champions.—The Mighty Sullivan.—The Magic of Jim Corbett.—Mike Donovan and Theodore Roosevelt.—Bob Fitzsimmons, Master Hypnotist.—McCoy and His Winning Corkscrew.—Jeffries, the Gentle Grizzly.—Dempsey, the Dynamiter.—Tunney, Captain of Fistic Industry.

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198. Egan, Pierce. "Doings and Sayings in the Prize Ring: Dick Curtis and Perkins." (In his *Book of Sports and Mirror of Life.* London, Printed for W. Tegg, 1847. p. 24–28) X In double columns. A round by round description of the fight.

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204. Egan, Pierce. *Every Gentleman's Manual;* a lecture on the art of self-defence; with animated sketches of the most celebrated pugilists during the last century; also, a visit to the Irish champion's tomb; embellished with several attitudes of the most accomplished boxers in the p. r.; likewise a spirited etching of John Jackson, Esq., illustrating the advantages of a knowledge of the art of self-defence to the late Lord Byron. London, Sherwood and Bowyer, 1845. 199 p. X

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211. Geer, Alpheus (Marshall Stillman, pseud.) *Great Fighters and Boxers;* psychology of the ring, including some very interesting stories not generally known. New York, Marshall Stillman Association, 1920. 96 p. illus. (Book three) X

212. Harding, William Edgar, comp. *The Champions of the American Ring;* a complete history of the heavy-weight champions of America, with their battles and portraits, executed expressly for this book; complete and authentic; the only book of its kind in the world; 6th ed. New York, R. K. Fox, 1881. 54 p. X

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221. Lynch, John Gilbert Bohun. *Knuckles and Gloves;* with a preface by Theodore Cook. New York, Holt, 1923. 217 p. illus. X " A history of the prize ring by an English college man telling the story of famous prize fights from 1738 to the Carpentier and Cook encounter in London in 1922. His tale has obviously a sordid side, yet more evidently a brutal one." A. L. A. Catalog.

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(Notation refers to number of item)

BOOK REVIEWS

ATHLETIC INJURIES, PREVENTION, DIAGNOSIS AND TREATMENT. Augustus Thorndike, Jr., M.D. (Philadelphia: Lea and Febiger, 1938) 208 pages, $3.00.

Dr. Thorndike, since 1932 a surgeon in the Department of Hygiene at Harvard University where his duties include care of athletic injuries, discusses the prevention of injuries in athletics, presents data concerning the more common types, and describes the diagnosis and treatment of these more common injuries according to the region of the body in which they occur.

Short chapters concisely discuss fitness, training, and fatigue. Well documented and indexed, this book presents interpretations of the newer researches in the physiological effects of exercise. For instance, one of the researches described is a recent study of the distance runners—Lash, Cunningham, San Romani, Venzka, and Fenski. Robinson, Edwards, and Dill, the experimenters, found that these runners adapted themselves readily by attaining a high oxygen intake and keeping their lactic acid at a fairly low level.

Data taken from a comprehensive five-year study of all athletic injuries at Harvard is the basis for the classification of injuries into groups of more common types, not an arbitrary opinion of the author.

Part Three relates to diagnosis and treatment. Illustrations and pictures are frequent and clear. They are of considerable value to many of us who are responsible for the care of injuries. This book will be useful to team physicians, to trainers, and particularly to the multitude of high school coaches who are responsible for the care of the minor injuries of their athletic squad members. It will be found most useful as a handy practical reference. Every institution sponsoring teams will find frequent use for this book.

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THE ORGANIZATION AND ADMINISTRATION OF PHYSICAL EDUCATION. Edward F. Voltmer and Arthur A. Esslinger. (New York: F. S. Crofts and Co., 1938) 467 pages, $3.00.

"The best contribution to the literature in the field of physical education is an answer based upon reliable data to the many questions which daily confront the teacher-administrator." In their book, Voltmer and Esslinger have taken problems such as arise in the practical situations of organization and administration of physical education, and have dealt with them on the basis of findings derived from carefully directed field studies of these problems. Adequate statements of basic principles and philosophy are also included. The book savors of a practicality that makes it enticing reading, and is virtually a handbook for the administrator in physical education. Not only are the traditional relationships of physical education given attention, but related groups and organizations are discussed.

The first few chapters state what phases of the organization and administration of physical education are to be stressed, the sources of data used, and justification for the use of the particular data, the setting or place of physical education in the general education program, and finally, the aims and objectives of physical education. Considerable space is given to an analysis of the aims and objectives as they

are subjected to zoological, sociological, psychological, transfer, and educational criteria. Chapter Four plunges into the field of administrative policies and activities, setting up guiding policies under the general head of staff, students, public, opponents and competitors, and the educational system. This section is concluded with some departmental organization charts.

An effective summary of the physical education program has been made in Chapter Five. One of the high points of the book is Chapter Six, which deals with the staff. Significant in this chapter is the space given to the secretary, recognizing her worth in a successful administration. The chapter on "School Health Education" treats this phase of the work from the broad viewpoint which is characteristic of the present trend in school health work.

A summary of significant considerations under the heading of "The Physical Education Plant" should prove unusually valuable in those centers where building, either new or altering, is contemplated. A solution to many perplexing problems in gymnasium construction is offered and with material of this kind at hand the administrator of health and physical education should be able to offer valuable service to the department of buildings and grounds.

Two chapters have been given over to a discussion of athletics—the first on interschool athletics, and the second on intramural athletics. The chapter on interschool athletics has an up-to-date discussion of that moot question on interschool athletics for girls. Playdays, control of athletics, medical supervision of athletics, legal liability for injury, and athletic conferences and associations are treated. The chapter closes with some suggestions regarding eligibility. All phases of intramural competition have been given brief treatment, with special attention to various types of devices for organizing competition. Much has been said about the leadership opportunities in physical education. The authors have some suggestions for this leadership in Chapter Eleven. Chapter Twelve deals predominantly with problems and details involved in conducting physical education classes. Chapter Thirteen gives some terse suggestions and works with them relative to budget making and finance, which is followed by a more elaborate discussion of the purchase and care of equipment.

At this point the book takes a new turn and the social interpretation of public school relations phase is discussed. A check list is included which should be very helpful to the administrator in drawing up his program of publicity.

Chapter Sixteen deals with recreation. Following a general statement of the importance of recreation in the physical education program, there appears a detailed list of duties, activities, and special plans. Discussion of recreation quite naturally leads one into the chapter on physical education organization. The final chapter presents a challenging discussion for administrators relative to tests and measurements programs. A pertinent and valuable contribution to the whole book is the listing of selected references ranging from four to fourteen for each of the eighteen chapters.

The writing has largely been from personal experience and research, avoiding a mere summary of opinion. The book should be valuable not only as a text for class work, but also for the teacher in charge of activities, the administrator of physical education, and the general administrator who might desire additional information concerning the significance of physical education in the educational field.

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GROUP INSTRUCTION IN SOCIAL DANCING. Edith Ballwebber. (New York: A. S. Barnes and Co., 1938) 131 pages, $2.50.

Because little recognition has been given to the value of social dancing as a means of building correct social habits

in the elementary school, it has become the duty of the high schools and colleges to offer beginning, as well as advanced, instruction in this field.

Even on these upper school levels, group instruction has failed to produce the best results because of inefficient class organization. Men and women have been taught the same techniques. There has not been the necessary emphasis for men on step sequences, their variations and leading, nor for women the emphasis on principles of following.

Because of the increasing demand for trained teachers, it is necessary to have a sound book on group instruction which will not prove useless as the fads change, but which will deal with fundamental material adaptable to new trends.

Miss Ballwebber, in her book *Group Instruction in Social Dancing*, has thoroughly accomplished what she set out to do. The problems of group organization and presentation of material are treated in a concise, accurate, attractive, and basically sound manner. The author deals first with the importance of rhythmic development in the student so that he may adjust his steps without confusion to the waltz, tango, and fox trot, and dance easily to music of various tempi and accents. Suggestions are given to aid in this training.

The six common dance positions are explained and illustrated. Twelve foundation steps and six turns are graphically described and these are followed by forty different combinations of steps based on them. Besides this technical material, the book contains teaching hints, a list of common dance faults, an outline of modern ballroom etiquette, and practical party schemes for exchanging partners and getting acquainted. In addition, two series of lesson plans of ten lessons each have been included and conveniently charted.

The material is so unified that it takes only one page to fully describe a step, make remarks about it in the form of clarifying statements or descriptive words as teaching aids, and to explain the essentials of proper leading. Each foundation step has a word direction for each count and a foot diagram of both the lady's and gentleman's part. Since the same step pattern is often used in waltz, fox trot, and tango, but in different rhythms, the proper counting is given for all three forms. This is set up very simply in a column arrangement so that one can see at a glance the difference in the forms.

The difficult job of devising a foot diagram system which can be understood with a little concentration and patience has been well done. Miss Ballwebber's accurate key to the diagram is the essential aid. Her word descriptions are clarified by a glossary. Miss Peg Sidle is credited with the preparation of the foot diagrams and illustrations.

Whereas occasionally in recent years we have had brought to our attention new worth-while folk or tap dance books, we have experienced somewhat of a lag in social dance literature. We therefore welcome a book which so admirably and adequately meets the demand.

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SINGING FEET. Norma Schwendener and Bertha Crosland Pulford. (New York: Published by the authors, 1938) 35 pages.

Singing Feet brings to physical education a delightful collection of Dutch and German folk songs and dances for high school and college use. The compilation and arrangement of materials are indicative of the efficiency and good taste which has characterized the authors' work in this and other professional fields. The dances are arranged in ascending order of difficulty providing opportunity for the novice or skilled technician to find his level of achievement and to enjoy the new routines. The book presents an attractive appearance with its clear-cut figures and music score, its complete description of dance steps, and its alluring title and cover page.

Since the dances appearing in *Singing Feet* are not to be found in other books published in this country, persons interested in rhythmic activities will wish to procure a copy.

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RECREATIONAL PROGRAMS FOR SUMMER CAMPS. H. W. Gibson. (New York: Greenberg Publishers, 1938) 440 pages.

Drawing from an extensive and varied camping experience, H. W. Gibson has amassed in one volume an inclusive and practical collection of helpful recreational material to be used in the summer camp. The theory and philosophy of the play aspect have been left for others; the book aims to provide directors and counselors with a source book of interesting, diversified, and workable recreational procedures. The author lays no claim to originality, but rather to an experimental leaning which has directed the sorting and analysis of programs over the years.

Mr. Gibson might be listed as one of the pioneers in the camping movement, his interest reaching back to 1894. He was the founder and director for many seasons of Camp Becket, a boy's camp located in the Berkshire Hills of Massachusetts. His writings include such familiar titles as *Boyology, Camp Management, Library on Camping, The History of Organized Camping,* and others. He has served as President of the American Camping Association.

The book may be recommended, not for the completeness of its many chapters, but for the variety of their subject matter, the novelty of their ideas, and the bibliographies of additional material which are appended. The chapter devoted to "Treasure Hunts, Hikes, and Trails" furnishes ideas and information for the nature man, the counselor or the program director. The duties and minimum requirements of a trip leader might be a part of the in-training curriculum for all leaders. Emphasis is given to the purpose of the hike, the implication being that too many hikes are aimless, there being no reason for covering the ground other than to find something for the campers to do.

A weak point in most camps, and one which might be immeasurably aided from Gibson's treatment, is the "Rainy Day." Similarly valuable is the chapter devoted to "Floor Games." The two suggest an amazing array of games, many of simple construction, with which to while away many a stormy period. The discussion of badminton however, is inadequate in the light of the present extended interest in this indoor and outdoor sport.

The section devoted to story-telling will be found helpful by the counselor in charge of evening programs. The bibliography for this section includes stories for different ages and, even more valuable, information concerning the technique of telling stories.

The paper and pencil games, seldom used in the camp program, could form the foundation for a social evening during the winter months. Some are old, some are new, all are fun. The fact should be noted that much of the book is valuable material for play situations of whatever nature.

As a cabin counselor, one of the fear producing requests of the camping season for the reviewer was "Cabin Stunt Night." Most program directors fall back upon this form of camper participation as a last resort when other programs do not materialize. The counselor is notified not over two hours previous to the performance. With no time to rehearse and little time to create, the leader is thrown upon his past experience or source material which may be handy. Mr. Gibson devotes nine pages to stunts. Many of these would be "flops" on any stage, some of them would develop into howling successes, all of them would furnish excellent leads, stimuli for the imagination, ideas to be mulled over and nurtured.

Other chapters are concerned with campfire programs and outdoor cooking; aquatic sports, stunts, and pa-

geants; circus, burlesque dramatics, and unusual shows; creative programs, marionettes, informal dramatics, and play writing; informal dancing, barn dancing, folk and aesthetic dancing (with no space devoted to the aesthetic); Indian pageants, council-circle dances and games; tournaments, horsemanship, archery, and other outdoor sports; minstrel shows, group shows, mock radio broadcasts; special day celebrations; relay games; trick games and stunts for the body; dramatics and costuming, stage and (very meager) scenery construction; Sunday programs and services.

The above list of chapter headings will convince the reader that the book attempts to present a wide variety of helpful material and in so doing slights much. The arrangement of the material is not particularly orthodox, logical, nor convenient. Similar programs might well have been grouped into sections. Chapters poor in content might have been omitted entirely without detracting from the value of the volume.

With the above criticisms in mind, the reader is advised that the book might well be used often by the camp staff, and also be of considerable help to those dealing with youth in all fields—the director of physical education, the young peoples' religious director, the community recreational director, and others. The bibliographies will make up for any deficiency in content.

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TEACHING FOR HEALTH. Marguerite M. Hussey. (New York: University Book Store, 18 Washington Place, 1938) 312 pp.

Methodology in health education has been a topic for discussion and argumentation since health was expressed as the first cardinal principle of education nearly twenty years ago. In our enthusiasm for health, we have violated all the principles of good teaching and sponsored practices diametrically opposed to the philosophies to which we have given lip service. This has been illustrated in our various uses of such devices as health contests, health awards, health clubs, health stories, health plays, health songs and rimes, health games and rules. Further illustration will be found in our efforts to teach health through arithmetic, through history and geography, through art, through music, through science, through home economics, through physical education.

We have used perfect attendance, blue ribbons, red buttons, scrapbooks by the hundreds, charts and posters by the score to teach health. We have given health examinations; we have used morning inspections; we have weighed and measured; we have provided mid-morning lunches, and cod liver oil.

Children have talked about health, written about health, sung about health; they have played for health, drunk milk for health, stood straight for health, washed their hands for health, and gone on excursions to the neighborhood grocers for health. And then they frequently have come back to a school environment which was anything but healthy. Sometimes they have listened to teachers, worried in mind, sick in body and untidy in appearance extol health!

In all of these efforts health has been the *end*. It has been treated as a subject; something to be learned according to the traditional notions of learning. At the same time, however, we have recognized health as being different from arithmetic. We recognized health as having something to do with the body, the human biologic organism; and some of us discussed health as a "condition" or a "quality"—a state of being.

Obviously there has been a great deal of confusion in our thinking about health teaching. This has been a natural accompaniment of our various and sundry methods of teaching health. With inadequate and poorly defined goals, with varying definitions of terminology and expressions of philosophy, it has

been impossible for methodology to be anything but *hodgepodge*. There is much need for those of us who are interested in health teaching to put our own thoughts in order.

To help us do this, Dr. Hussey has given us *Teaching for Health*. This is a consistently sound book on method, based on the well accepted philosophy of optimal health as organismal efficiency for effective living and learning. Optimal health is dependent upon ways of living; it is a means to ends associated with life purposes. "The forces that affect health are many but only those that are directly or indirectly controllable by the educator are touched upon at length" in this book. Throughout the book the emphasis is placed on those incidents and behaviors that make for health in vital and interesting living. Health is not set apart as something to be attained in certain courses or at certain times of the day or year, the responsibility of a few specially prepared individuals. Teaching for health is conceived as a twenty-four-hour-a-day proposition, related to the total learning situation which surrounds the learner. As such, teaching for health becomes one of the *core* interests of the total curriculum.

The historical approach to health teaching presents some interesting and little known facts regarding the interest in hygiene of early writers such as Tissat (1762) and Hall (1869). The interests of Horace Mann and Catherine Beecher in school health are reviewed, and the teaching and content emphasis of early Twentieth Century hygiene textbooks is presented. This provides good background for an understanding of the modern practice of thinking of health teaching in terms of the total curriculum.

"Schools are more and more beginning to study their curricula with the view of determining whether the offerings, organization, and teaching techniques are such as to improve the health of the learner. (Historically speaking, therefore, it may be said that) as far as health instruction is concerned, there are three major trends discernible. The first was an emphasis on teaching information in the field of anatomy and physiology, and later, hygiene. The second tendency was the effort to 'train' the learner in desirable health habits, and the third was a stress on the necessity of developing interests or attitudes."

Dr. Hussey then continues with a discussion of factors influencing optimal health, that is, "every organ, every tissue, every cell—working in such a way as to give maximum efficiency with a minimum of wasted energy." Three major factors are stressed: heredity, environment, and activity—those experiences in which we all engage that result in various kinds of development and adjustment. These major factors are analyzed more fully and the relation of health to learning pointed out. The importance of the discovery and remedy of defects, of a well organized school program, of health practices within the home, are all commented upon.

Difficulties encountered in teaching for health are related to our failure to understand basic interests and motives underlying impulsive behavior. The problem of teaching for health without making the individual too health-conscious is a real one. This leads to a discussion of desirable traits to be developed—traits that will result in desirable changes in health behavior.

These traits are related to health information, "interests or self-impelling motives," and health practices or habits. The importance of applying health knowledge to daily life situations is stressed. The interest of people in feeling well in order that they might achieve the things they wish to achieve as a *basic* factor in teaching for health is emphasized. Keeping in condition to do the things one wants to do, might well become the center of the teaching process. The big problem is *how* teach children and adults the importance of *condition* when immediate interests are violations of the practices that will further optimal condition.

Several teaching suggestions are given: (1) healthful example on the part of

the teacher and natural leaders in the group, making keeping in condition the thing to do; (2) well organized classes and teaching techniques that make for good quality of work on the part of the pupils in a congenial, friendly learning situation; (3) proper classification of children according to abilities to minimize strain; (4) well selected activities, properly graded, with variety and sociability as two of the criteria, and with opportunity for relaxation; and (5) adequate time to accomplish that which is worth while without being a slave to a cut and dried schedule. The use of good advertising and developing social approval with health as a prerequisite for important positions are other suggestions.

Content for the program can be obtained by: (1) studying out-of-school life of the pupil and the community; (2) studying school life; and (3) studying the individual learner. Use of observation forms and check lists, examination of records, and interviews are some of the procedures for developing this content.

The actual process of teaching involves cooperation between home and school as well as "technical teaching" within the school. The use of incidental teaching, class discussion centering around health problems and needs discovered by the pupils, units of work growing out of pupil experience such as the health examination, or rating scales on health practices, or questions asked by pupils, and the use of such subjects as home economics, biology, and social studies to re-enforce direct discussion with accurate information are suggested as good teaching procedures. Considerable attention must be given to the ways in which these procedures are used, however, if the best value is to result. Suggestions for initiating and developing of units, for conducting discussions, and for using subjects like home economics add value to this portion of the book. Sample units for elementary and secondary levels are included.

The final chapter deals with the measurement of results. Measurement devices are only *estimates*. Some of these devices are: questionnaires, self-checks, teacher observations, records of defects corrected, health knowledge tests, absences from school, pupil retardation, weighing and measuring, and general report on health progress.

A list of sources for printed materials and an evaluation of motivating devices such as health clubs, competition, prizes, and awards are included.

"Teaching for Health" is a very good book; one that should help the health educator, interested in school problems, clarify his own thinking and his own concepts in an increasingly important field. The weaknesses of the book, strangely enough, lie in some of its terminology. Such phrases as "the conditioning process," "re-enforcing ideas and ideals," "development of traits," "for health teaching," "adjusting activities," "developmental activities," and "survival activities," to mention a few, may be confusing to the reader who has accepted other terminology. For one who is familiar with the Hetherington philosophy, however, this phraseology will be readily understood. The other weakness is the lack of an index. Nevertheless the book is well written; the initial thesis is consistently developed; and there are ample specific suggestions to make it usable by classroom teachers, school administrators, and health educators alike.

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